AUGUST 1957—SIXTY-THIRD YEAR

Machinery

Three identical 800 ton 8 station Verson Transmats each capable of making any of four different automotive parts at the rate of 1000 per hr.

Published monthly by
THE INDUSTRIAL PRESS
ROBERT B. LUCHARS
President
EDGAR A. BECKER
Vice-President and Treasurer
HAROLD L. GRAY
Secretary and Publishing Manager
Editorial, Advertising, and Circulation Offices:
93 Worth St., New York 13, N. Y.
Telephone, CAnal 6-8120

Subscription rates: United States and Canada, one year, $4; two years, $7; three years, $8; foreign countries, one year, $7; two years, $13. Single copies, 50 cents. Changes in address must be received by the tenth of the month to be effective for the next issue. Send old as well as new address.

Entered as second-class mail matter May 25, 1953, at the Post Office at Bristol, Conn., under the Act of March 3, 1879. Printed by Hildreth Press, Inc., Bristol, Conn., U.S.A.

British Address:
MACHINERY
National House, West St.
Brighton 1, England

French Address:
LA MACHINE MODERNE
15, Rue Bleue
Paris-IXe, France

BPA NBP

Machinery

AUGUST 1957 VOL. 63 NO. 12

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

SHOP PRACTICE

MACHINE AND TOOL DESIGN

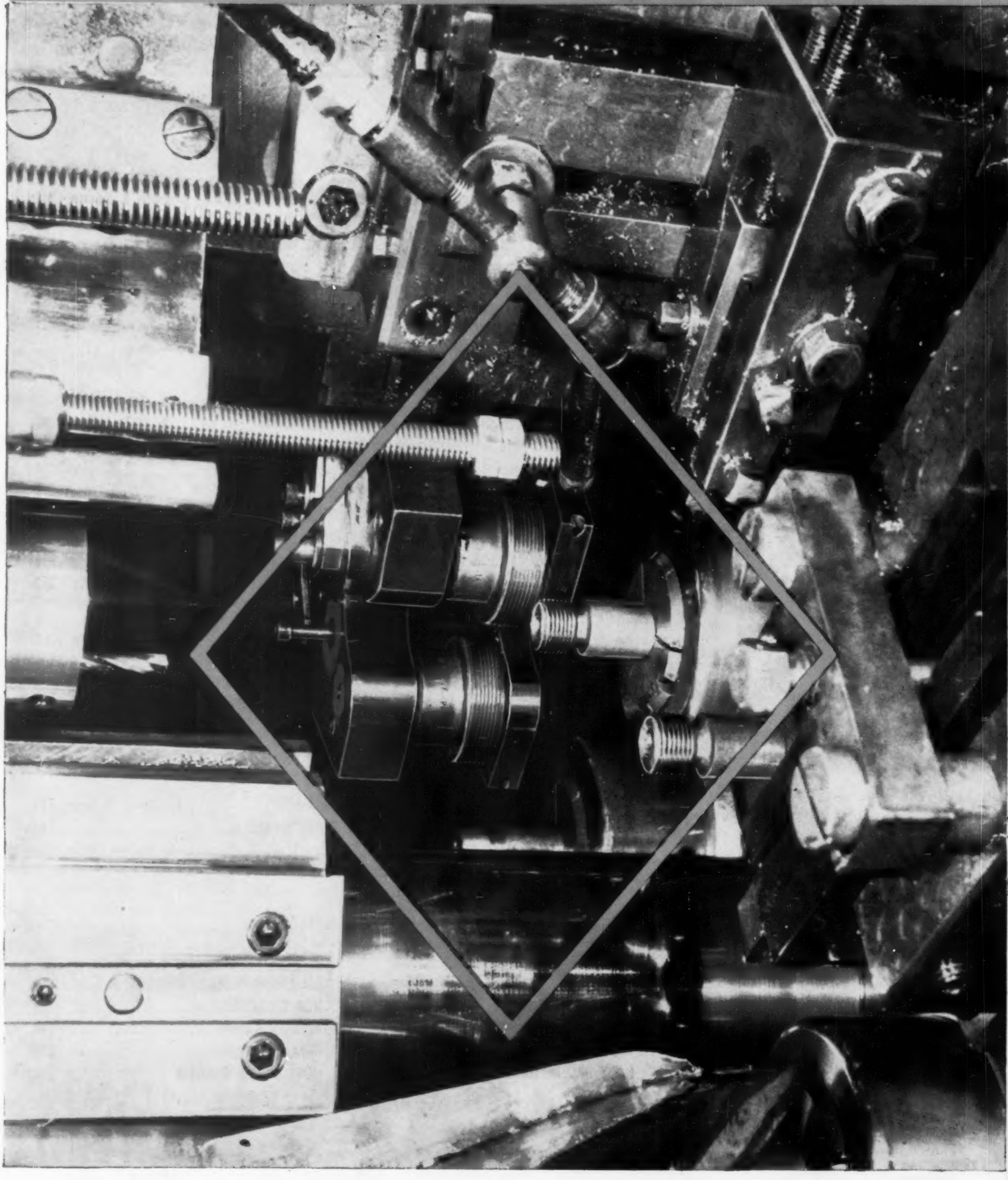
REFERENCE SECTION

MANAGEMENT PROBLEMS AND EVENTS

DEPARTMENTS

Society of Business Magazine Editors

$\frac{1}{2}''$ taper pipe thread



rolled with the LANROLL attachment

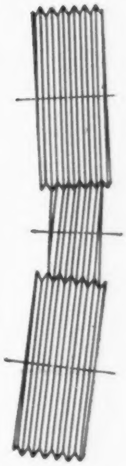
The recently developed LANDIS Method for precision rolling of taper pipe threads is shown at the Mac-It Parts Company, Lancaster, Pennsylvania, in the production of pipe plugs.

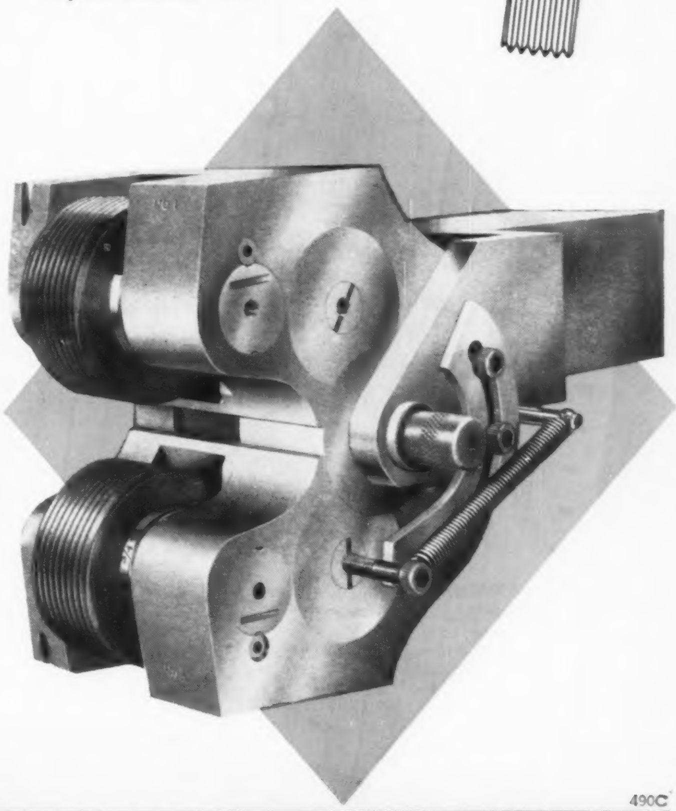
1/2" 14 pitch American Standard Taper Pipe threads are being rolled 9/16" long to dry seal specifications on 4140 steel (207 Brinnell). The #22GA LANROLL Attachment (with a pipe range of 1/8" to 1") is used in the third position on a National Acme Bar Automatic —45,000 pieces are threaded with each set of rolls.

To produce the taper, the rolls of the LANROLL Attachment are supported on carbide shafts inclined to the required thread taper. This design enables the use of parallel rolls (see diagram) which reduces slippage between the workpiece and rolls. With reduced slippage, roll life is materially increased. In addition, attachment stabilization (limited sidewise movement) is greatly improved to permit rolling directly to a shoulder with safety.

A highly desirable design feature of the LANROLL Attachment is the ability to remove the attachment from the shank by simply withdrawing the shank pin. By this means, machine tooling changes or attachment servicing can be accomplished without disturbing the original set up. This same construction facilitates, through the use of a gage, a precision, safe means for locating the attachment on the tool slide in respect to the high point of the machine's feed cam. Also, it allows attachment tipping to avoid indexing interference on screw machines having a limited tool slide movement. The same LANROLL Attachment will produce either straight or taper threads by using the proper rolls and an important but limited amount of auxiliary equipment. They provide wide range coverage while retaining the rigidity of a non-adjustable tool—assuring operation for every size within its range as though it were exclusively engineered for the particular work being threaded.

For complete information on the LANDIS Method of rolling taper threads and other outstanding design principles, please write and request Bulletin G-96.



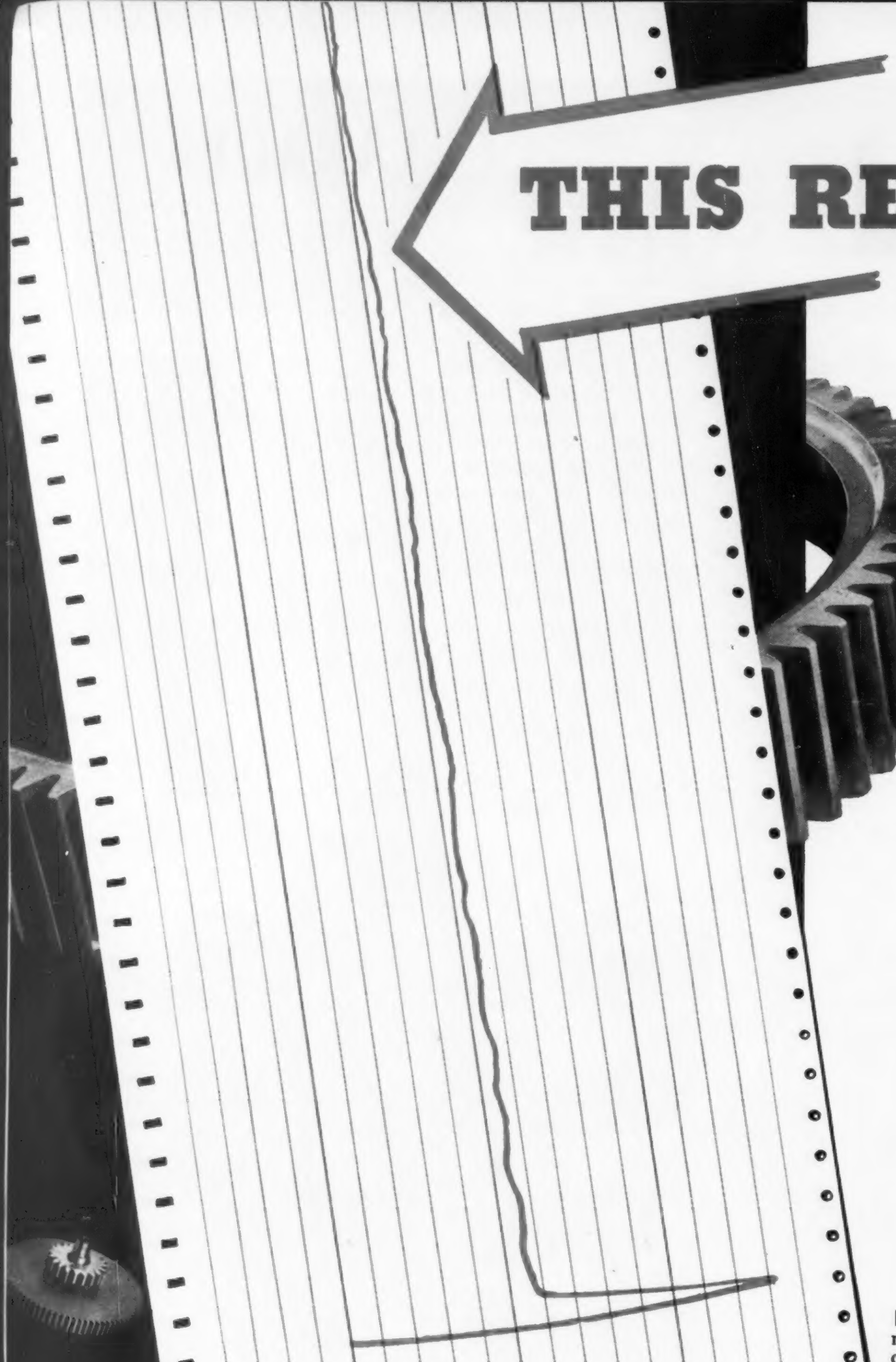


490C

LANDIS Machine COMPANY

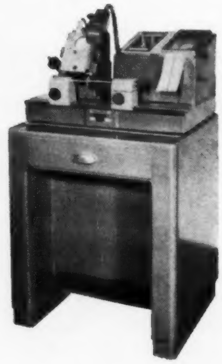
WAYNESBORO • PENNSYLVANIA • U. S. A.

For more information fill in page number on Inquiry Card, on page 223



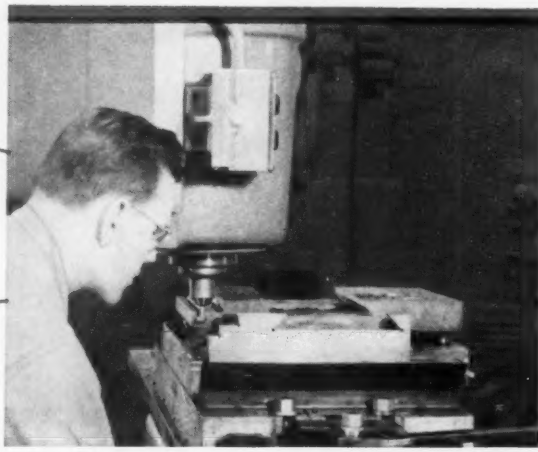
THIS RED LINE

"IN



Fellows Red Liner: Automatically makes and records a composite check of all gear errors in combination. Three capacities.

THE
PRECISION
LINE



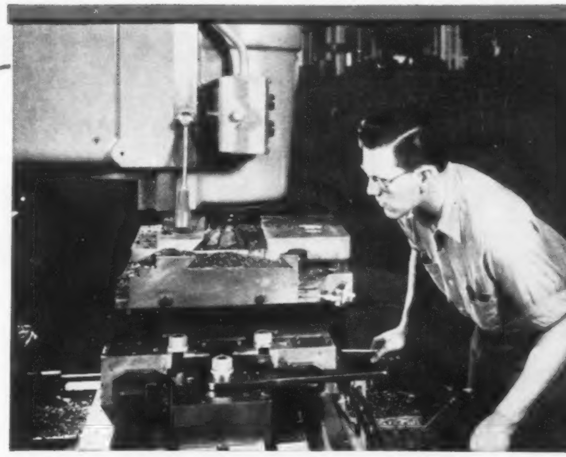
Milling the T-slot. Cincinnati Rear Controls and Power Drawbar are exceptionally useful features of convenience for this operation.

Cincinnati Power

the new push-button

At the touch of a button, cutters are tightened and released in the machine spindle.

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES



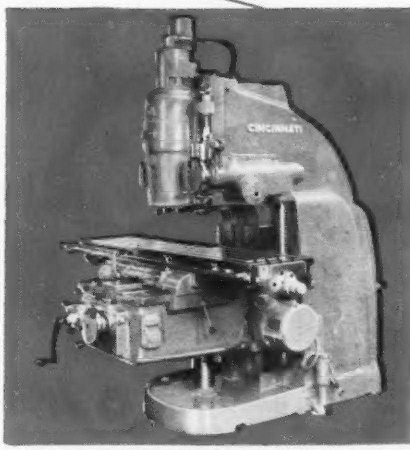
Dovetail milling operation. This cutter is one of several required for 14 different milling cuts in one setting of the work.

Drawbar Attachment

way to frequently change cutters

Small lots of parts requiring a number of milling operations always present a knotty problem. There are two solutions: leave the work in the fixture and change cutters for each operation, or leave the cutter in the machine and remove the work after performing one operation at a time, and reset for the next operation. You can solve this problem once and for all with CINCINNATI Milling Machines equipped with Power Drawbar Attachment. Then for multiple operation work, changing cutters becomes a simple push-button chore. Push one button and the arbor is tight in the machine spindle; push another button and the arbor is released. A few seconds' time does it! ¶ The illustrations show the Power Drawbar unit on a CINCINNATI® No. 3 Vertical Dual Power Dial Type Milling Machine. Of course the machine itself is the big factor in reducing the cost of a variety of milling operations. It has 24 spindle speeds 16 to 1600 rpm; 32 feeds ⅜ to 90 ipm; power speed and feed selection with a single lever; automatic backlash eliminator; automatic table feed cycles; power feed to vertical head, and 22 additional advantages outlined in the catalog. Want a copy? Ask for publication M-1917-3. Brief specs in Sweet's.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO



CINCINNATI **Vertical Dual Power Dial Type Milling Machine** equipped with Power Drawbar Attachment. Catalog M-1917-3.

Brief Specs, *Vertical High Power and Dual Power Dial Type Milling Machine

Size	No. 2	No. 3	No. 4	No. 5	No. 6
Range: longitudinal	28″	34″	42″	50″	60″
cross	14″	16″	18″	18″	18″
vertical	14″	16″	16″	16″	16″
vertical head	6″	7″	8″	8″	8″
24 spindle speeds	16 to 1600 rpm		14 to 1400 rpm		
32 feeds	⅜ to 90 ipm		⅜ to 90 ipm		
Main motor: High Power	15 hp	20 hp	25 hp	25 hp	25 hp
Dual Power	20 hp	30 hp	50 hp	50 hp	50 hp

*Cincinnati also builds Plain Machines Nos. 2 to 6 sizes, and Universal Machines, Nos. 2 to 5 sizes.

CINCINNATI

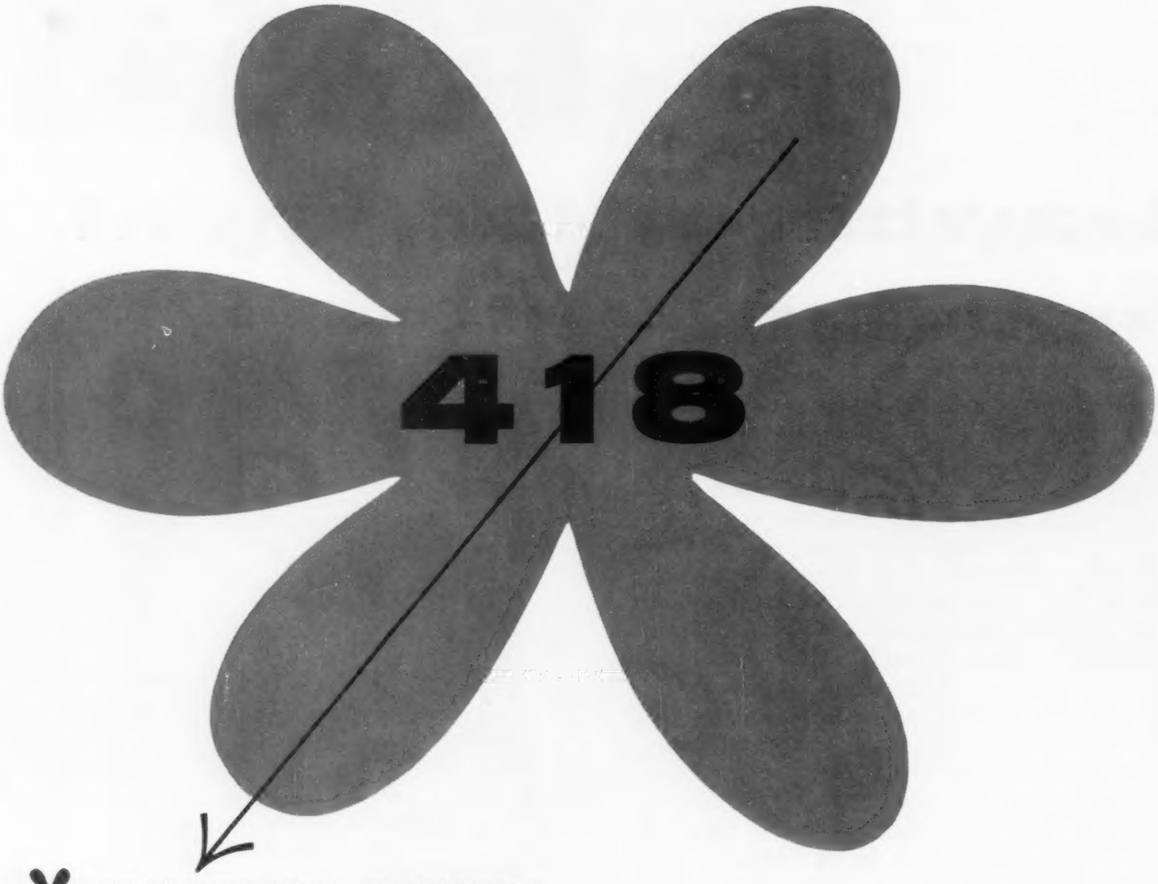
HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

For more information fill in page number on Inquiry Card, on page 223

Get Accurate, Low-Cost

with a

VAN NORMAN



✱ CYLINDRICAL GRINDER

The Van Norman 418 Cylindrical Grinder is engineered to give you fast, accurate, low-cost plunge and traverse — small parts grinding, particularly if you have small or medium sized runs.

With the 418 you get big machine economy and performance at small machine cost. Setups are quick and easy . . . workpieces are easily loaded, ground and unloaded. Get full details on the Van Norman 418 . . . write, wire or phone now for complete specifications.

VAN NORMAN MACHINE

a division of Van Norman Industries, Inc.

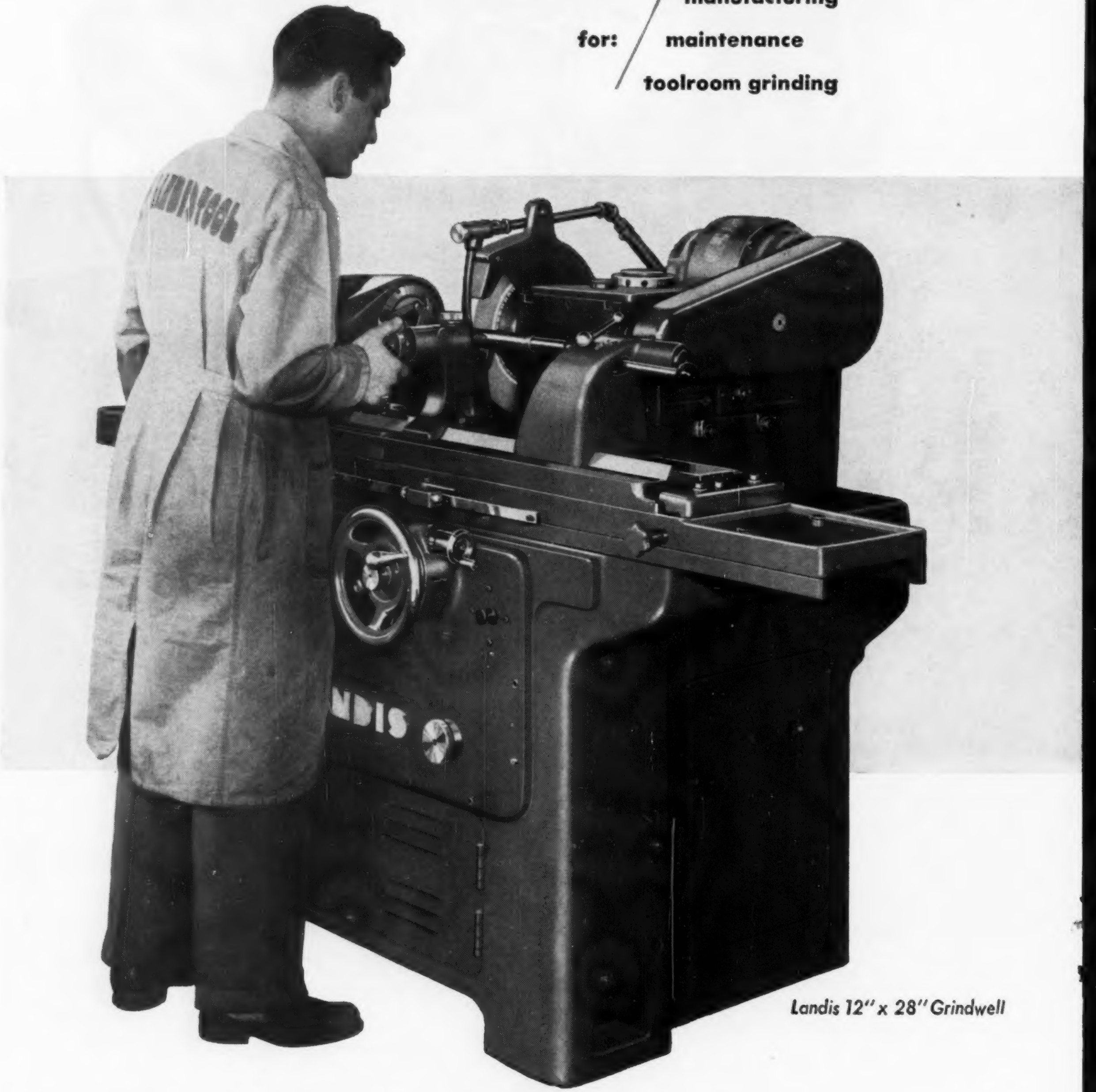
MANUFACTURERS OF — Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

For more information fill in page number on Inquiry Card, on page 223

Low cost Landis Grindwell gives

...exclusive features permit quick setup...assure precision tolerances

for:
- **manufacturing**
- **maintenance**
- **toolroom grinding**



Landis 12" x 28" Grindwell

LANDIS

precision grinders

LANDIS TOOL COMPANY

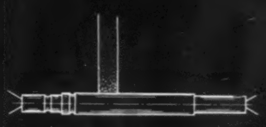
"big grinder" performance

Exclusive Feature: Variable speed headstock . . . compact design with only two revolving parts. Can be swiveled for angle or face grinding.

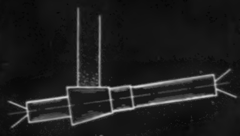
Exclusive Feature: Microsphere bearings . . . close running clearance of Landis Microsphere bearings gives faster spark-out, accurate, quick response to wheel feed.

WAYNESBORO, PENNSYLVANIA

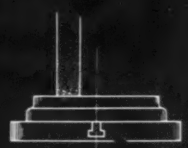
typical grinding operations



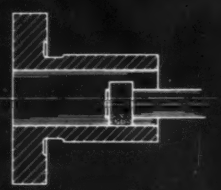
straight cylindrical



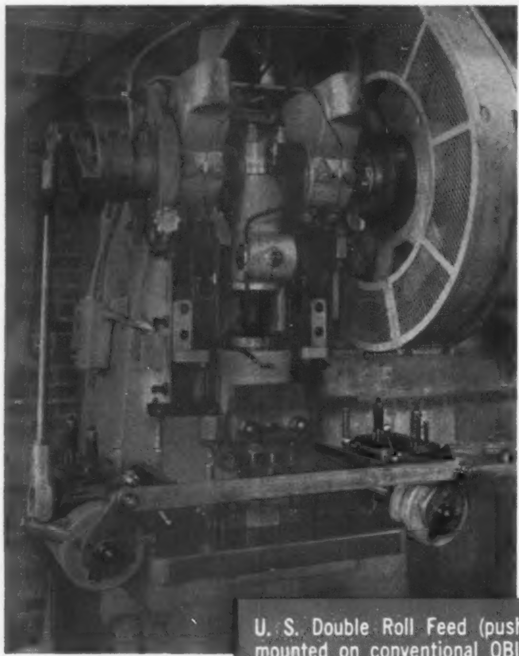
taper



face and angle

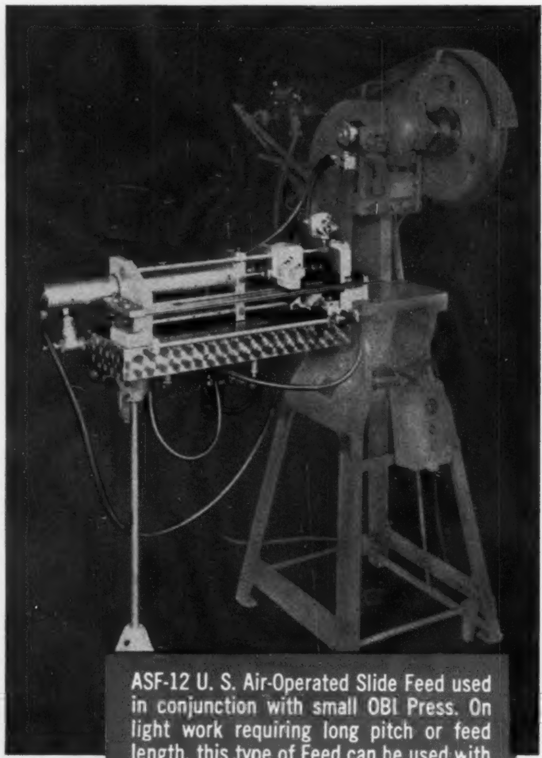


internal

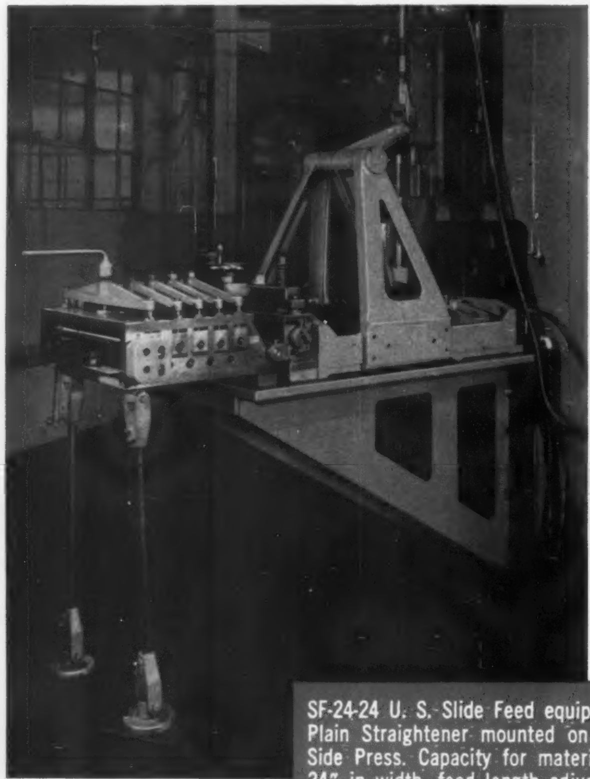


U. S. Double Roll Feed (push-pull type) mounted on conventional OBI Press. Direction of feed can be either right to left or left to right. Made in range of sizes.

IMPROVE PRESS-ROOM



ASF-12 U. S. Air-Operated Slide Feed used in conjunction with small OBI Press. On light work requiring long pitch or feed length, this type of Feed can be used with presses much smaller than would ordinarily be required.



SF-24-24 U. S. Slide Feed equipped with Plain Straightener mounted on Straight Side Press. Capacity for material up to 24" in width, feed length adjustable up to 24" per stroke. Same type of Feed made in smaller sizes.

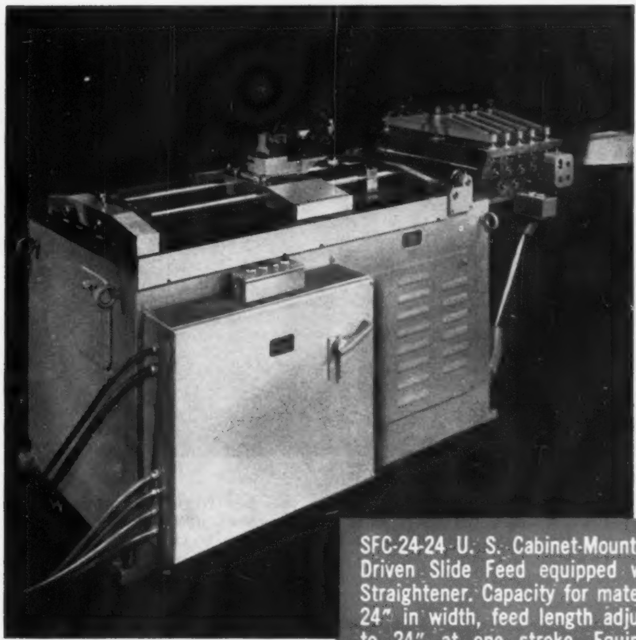
PRODUCTION WITH THESE U S PRODUCTS

Gain all the advantages from the use of coil stock in your Press Room by arranging your presses with automatic equipment. The illustrations show just a few of the many units included in the line of U. S. Automatic Press Room Equipment designed and built to aid you to reduce costs and increase production. Every operation eliminated will increase your profit potential and place you in a more favorable position in today's competitive market.

Investigate! Ask for copies of Bulletins 80-M and 95-M.

U. S. TOOL COMPANY, INC.

Ampere (East Orange) New Jersey

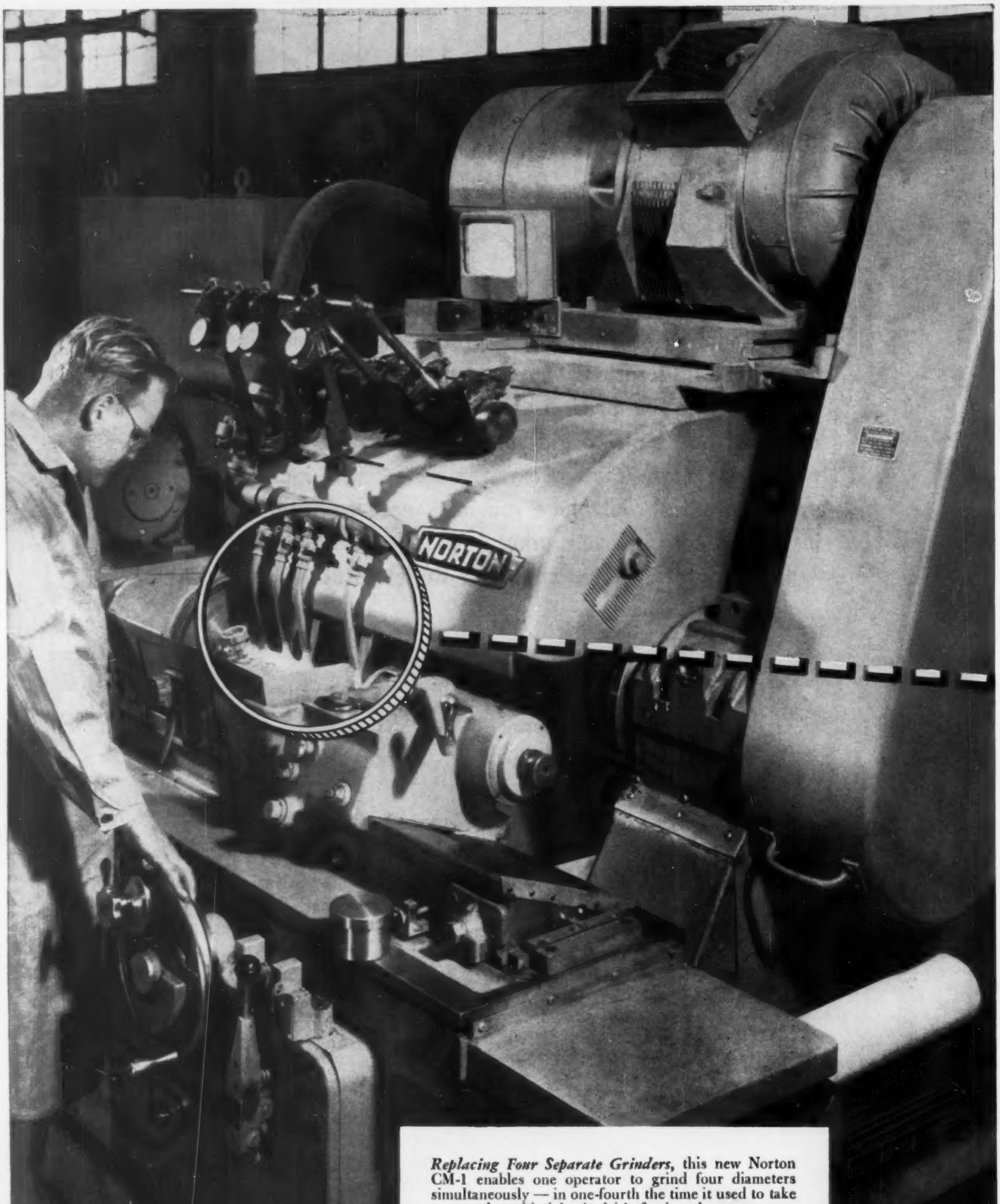


SFC-24-24 U. S. Cabinet-Mounted Motor-Driven Slide Feed equipped with Plain Straightener. Capacity for material up to 24" in width, feed length adjustable up to 24" at one stroke. Equipped with counter to permit multiple stroking to obtain longer lengths.

★ **U. S. PRODUCTS**

- Slide Feeds
- Roll Feeds
- Stock Straighteners
- Stock Reels
- Stock Oilers
- Coil Cradles
- Wire Straighteners
- Die Sets
- Multi-Slides ®
- Multi-Millers ®

For more information fill in page number on Inquiry Card, on page 223

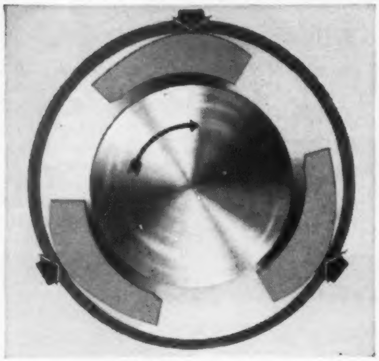


Replacing Four Separate Grinders, this new Norton CM-1 enables one operator to grind four diameters simultaneously — in one-fourth the time it used to take to complete this job. And it's freeing three operators for other jobs!

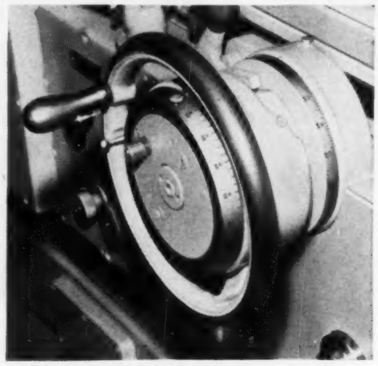
For more information fill in page number on Inquiry Card, on page 223

These Cincinnati

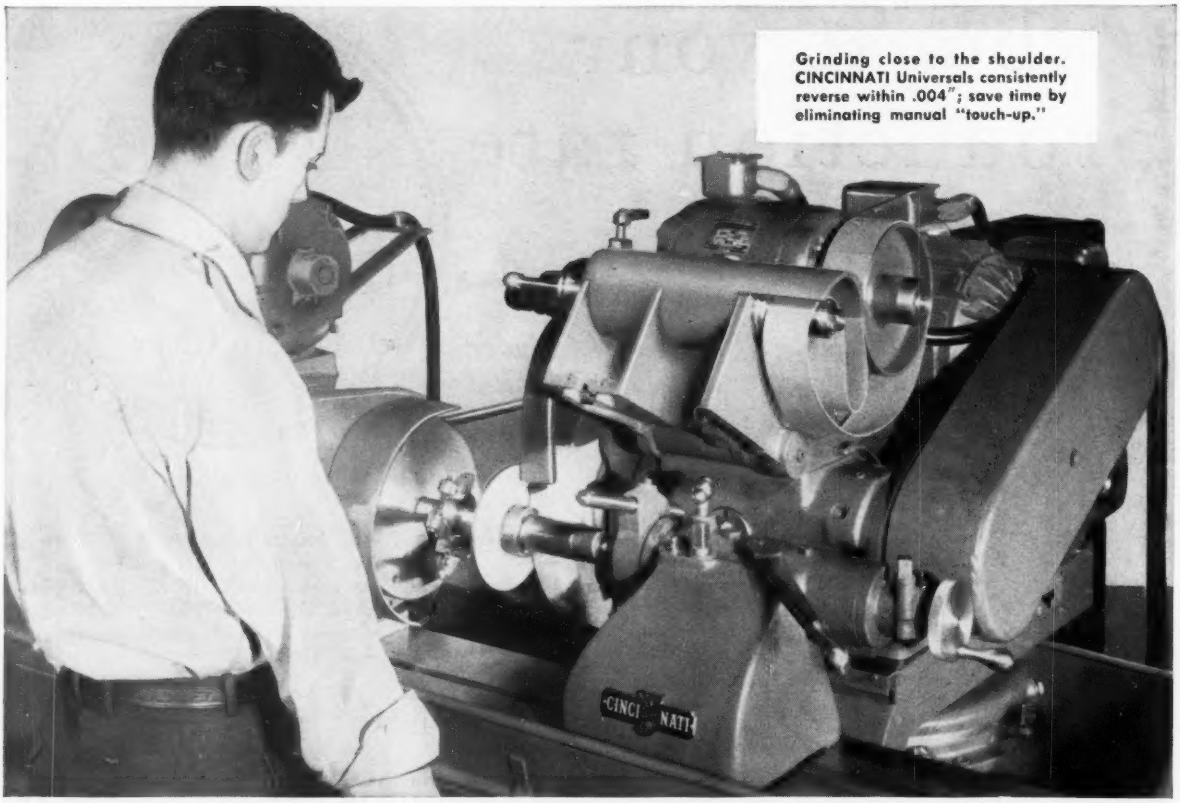
keep your setup



FILMATIC Self-adjusting
grinding wheel spindle bearings



Two-speed
cross traverse handwheel



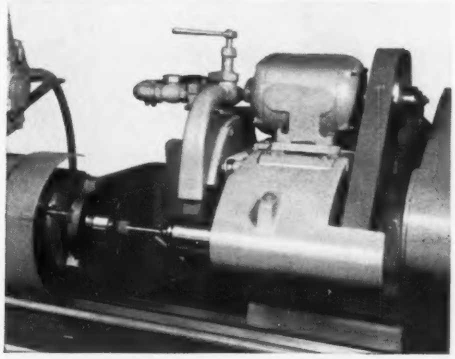
Grinding close to the shoulder. CINCINNATI Universals consistently reverse within .004"; save time by eliminating manual "touch-up."

CINCINNATI

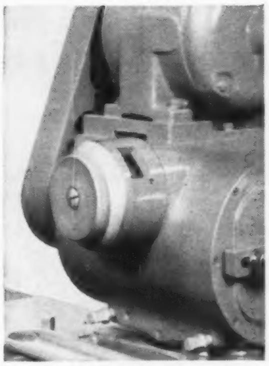
CINCINNATI

timesavers

from showing on the cost record



Hinge mounted
internal grinding unit



Dial selection
of headstock spindle speeds

Small manufacturing quantities may be good for inventory accounting, but they're tough on costs. In precision toolroom grinding, CINCINNATI® FILMATIC Universals offer several ways to eliminate or greatly reduce the setup element of cost.

FILMATIC grinding wheel spindle bearings require no adjustment for any job assigned to the machine.

Two-speed cross feed mechanism facilitates quick positioning of wheelhead for multiple diameter grinding; incorporates pickfeed all the way to final size.

Internal grinding unit is hinged at the front of the wheelhead casting, always ready for internal work.

Instant work speed selection for the diameter being ground. Just turn the dial with one hand, that's all there is to it.

Power rapid positioning of wheelhead. Saves time and energy, especially when setting up for widely varying diameters (extra equipment).

Power positioning
of wheelhead

FILMATIC

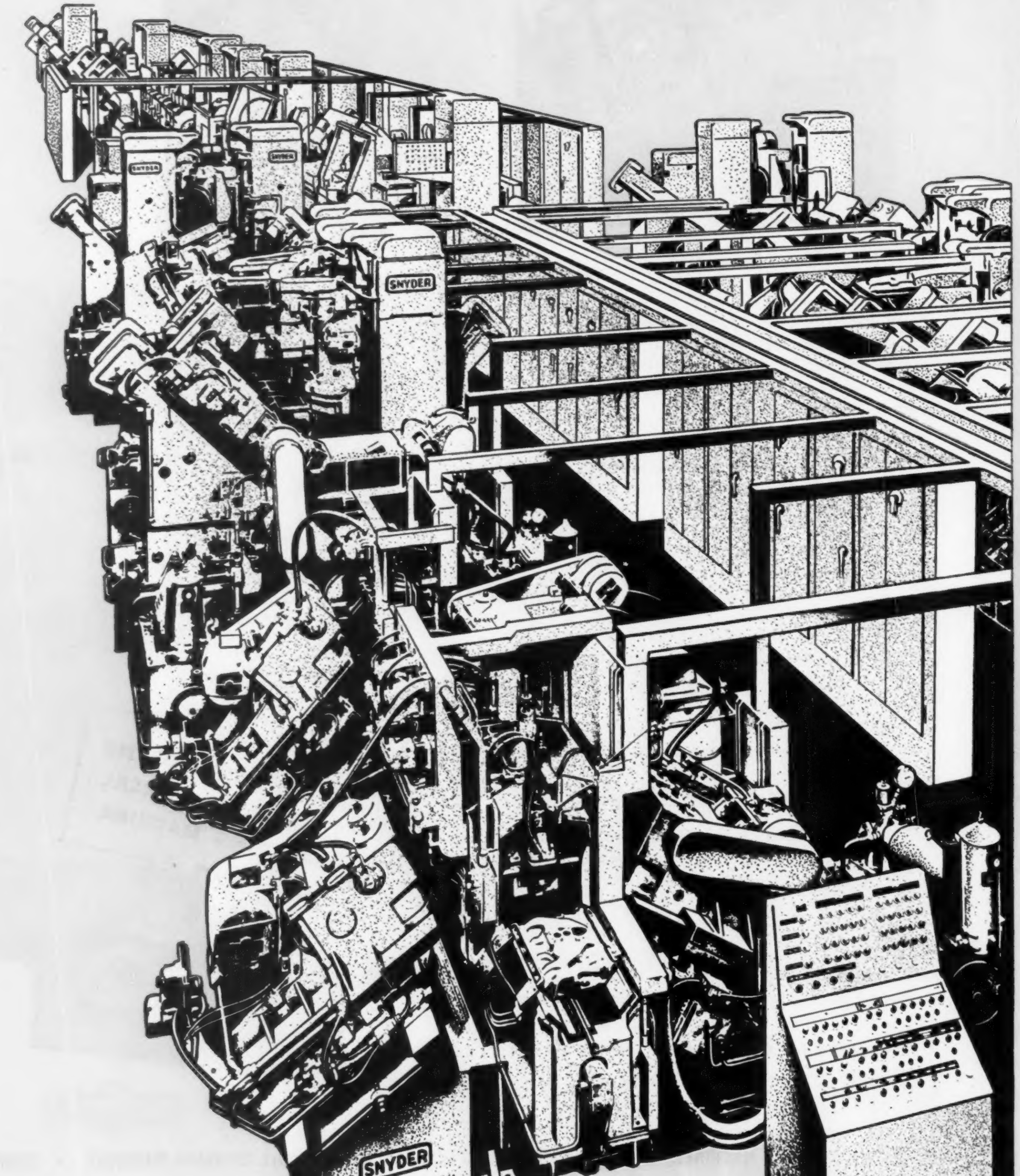
Other ways in which CINCINNATI FILMATIC 12", 14", 18" Universal Grinders can reduce costs in your shop are outlined in catalog No. G-663-1. May we send a copy to you? You will find brief specifications in Sweet's.

CINCINNATI GRINDERS INCORPORATED
CINCINNATI 9, OHIO

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES • ROLL GRINDING MACHINES • SURFACE GRINDING MACHINES • CHUCKING GRINDERS • MICRO-CENTRIC GRINDING MACHINES • CENTERLESS LAPPING MACHINES

For more information fill in page number on Inquiry Card, on page 223

Unique Combination of Snyder Special Two or Four Barrel Intake Manifold



Giddings & Lewis

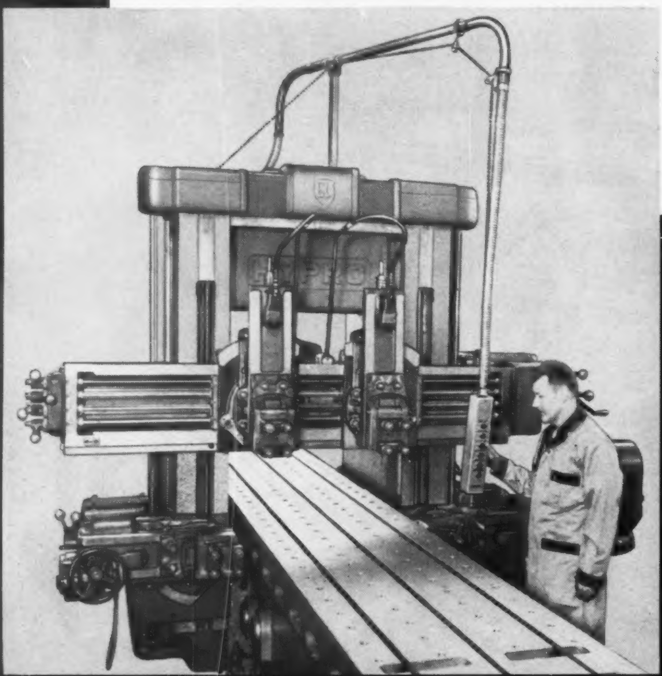
HYPRO DOUBLE HOUSING PLANERS

PROVEN Giddings & Lewis HYPRO double housing planer features offer you utmost rigidity for heavy duty machining with either high-speed steel or carbide tools . . . up to 400 surface feet per minute.

What's more, the *dual rail controls* enable you to select feeds and *rapid traverse* from either side of the machine. Adjustable cut and return speeds permit the right selections for all cutting conditions. The *patented electric dial feed* is easily adjustable over a wide feed range. *Power rapid traverse* to all heads,complete with direct current braking, assures close-positioning control. The extra depth, one-piece rail and double length, enclosed bed provide additional strength and rigidity for high-speed planing of large workpieces.

These progressively engineered Giddings & Lewis HYPRO double housing planers are offered in 23 standard sizes, in work capacities from 30" to 144" widths . . . to any length desired. Motor drives range from 25/50 through 100/200 hp, assuring ample power to plane at speeds up to 400 fpm. Machines can be furnished with choice of 1, 2, 3, or 4 heads. Special frog and switch, as well as die block models, in complete line are also available.

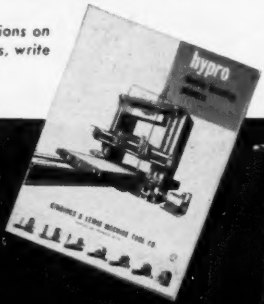
For more information on G&L and HYPRO double housing or openside planers, contact your nearest Giddings & Lewis representative, or write direct.



HYPRO 36" x 36" double housing planer at left.

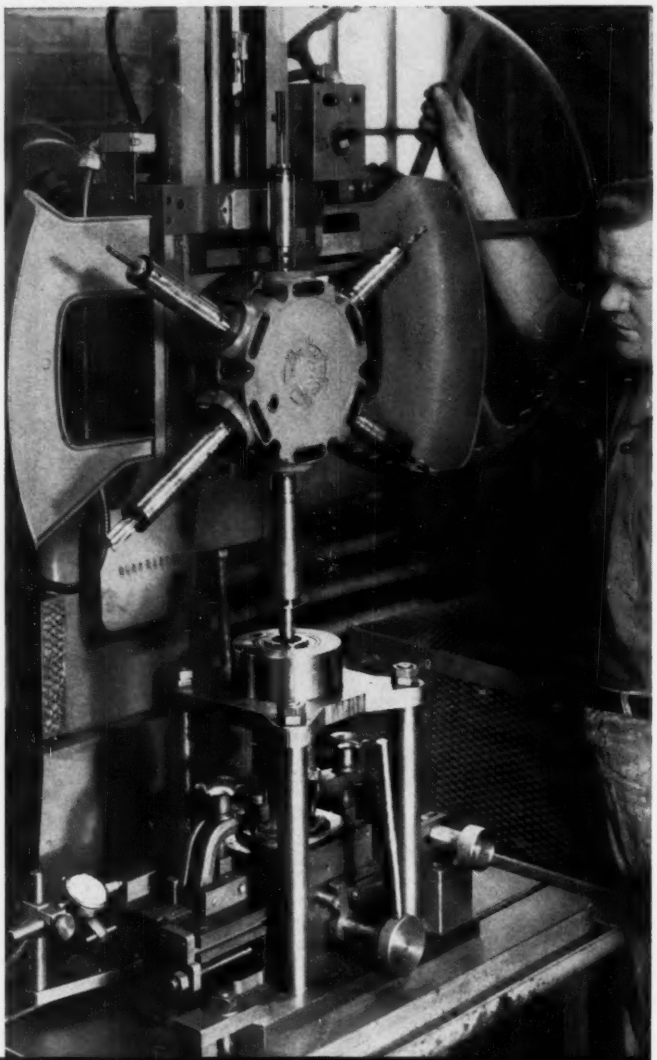
HYPRO 144" x 144" double housing planer at right.

For complete specifications on double housing planers, write for Bulletin No. 250.




GIDDINGS & LEWIS
HYPRO

"Our BURGMASTER® turret drill saves 43% running time over turret lathe"



Graymills Corporation, Chicago

states "two things make operations on the gear pump body casting somewhat unusual. (1) gear pockets are *bored* to close tolerances; (2) *both* pocket and shaft holes are machined on different centers by shifting the casting approximately ¾" in the fixture.

The setup, as worked out on our Burgmaster equipped with Power Feed, (see illustration) is producing much more accurate pieces with fewer rejects. Our running time is 57% of that on the turret lathe and we have been able to release the much more expensive lathe for other work. In addition, the Burgmaster is much easier to operate."

Sequence of operations on 6-spindle Burgmaster turret drill is as follows:

1	Load	9	Counter bore—rough 2nd gear pocket
2	Counter bore—rough 1st gear pocket	10	Bore—finish 2nd gear pocket
3	Bore—finish 1st gear pocket	11	Skip
4	Drill—rough ½" shaft hole	12	Drill—rough ⅜" shaft hole
5	Skip	13	Skip
6	Ream—finish ½" shaft hole	14	Ream—finish ⅜" shaft hole
7	Skip	15	Unload
8	Shift fixture—hold tolerances by using dial indicator		

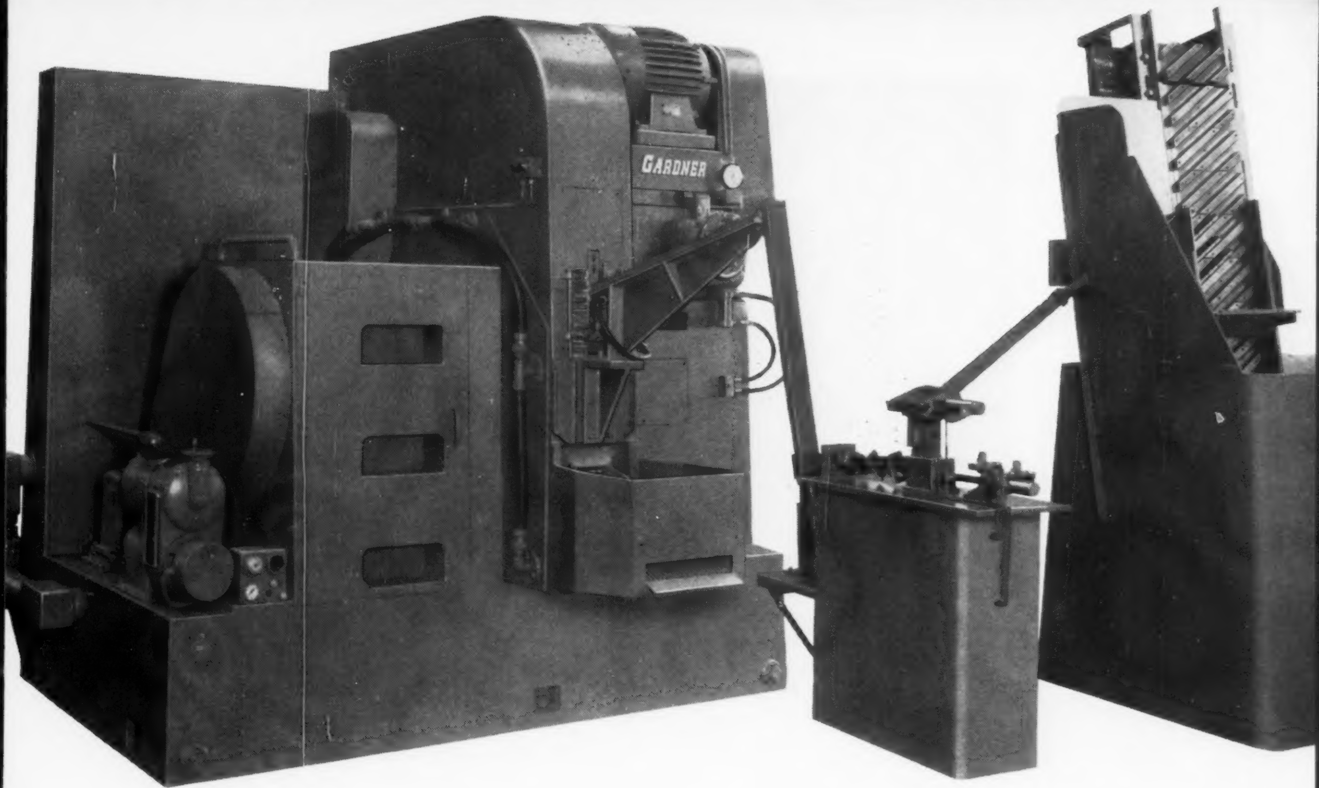
Note arrangement of tooling sequence. By skipping stations, machining of the entire piece and shaft holes of two different sizes is possible. Depth is controlled by the standard Burgmaster micro-stops. All dimensions are ±.0005".

For complete information, write Dept. M-8

BURG TOOL
Manufacturing Company, Inc.
15001 South Figueroa Street, Gardena, California

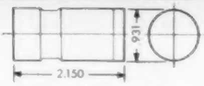
RIDGEWOOD, N. J. • CHICAGO • CLEVELAND • DETROIT • SAN LEANDRO, CALIF.

For more information fill in page number on Inquiry Card, on page 223



Gardner 723-23″ dual horizontal spindle grinder rough and semi-finish grinds 3000 valve lifter bodies per hour.

Gardner automatic operation increases output ... grinding hydraulic valve lifter bodies

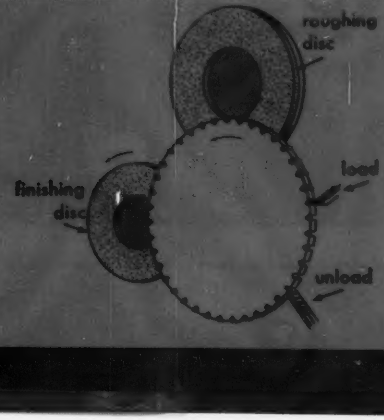


production data

Operation.........Grinding closed end of hydraulic valve lifter body
Material:..........Cast iron
Rate:..............3000 per hour
Stock Removal—
Rough cut: ....012″-.038″
Semi-finish cut: ....006″-.008″
Uniformity:.........002″
Squareness:.........0005″

special machine equipment

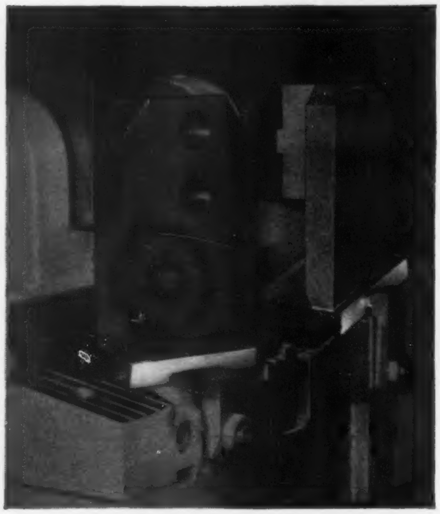
hopper feed
transfer attachment
rotary carrier
two Gardner sizing units with automatic feedback
centralized lubrication
head zeroing gages
power-operated increment head feed
30″ & 23″ Yellow-Rim Wire-Lokt® discs
automatic loading and unloading



GARDNER

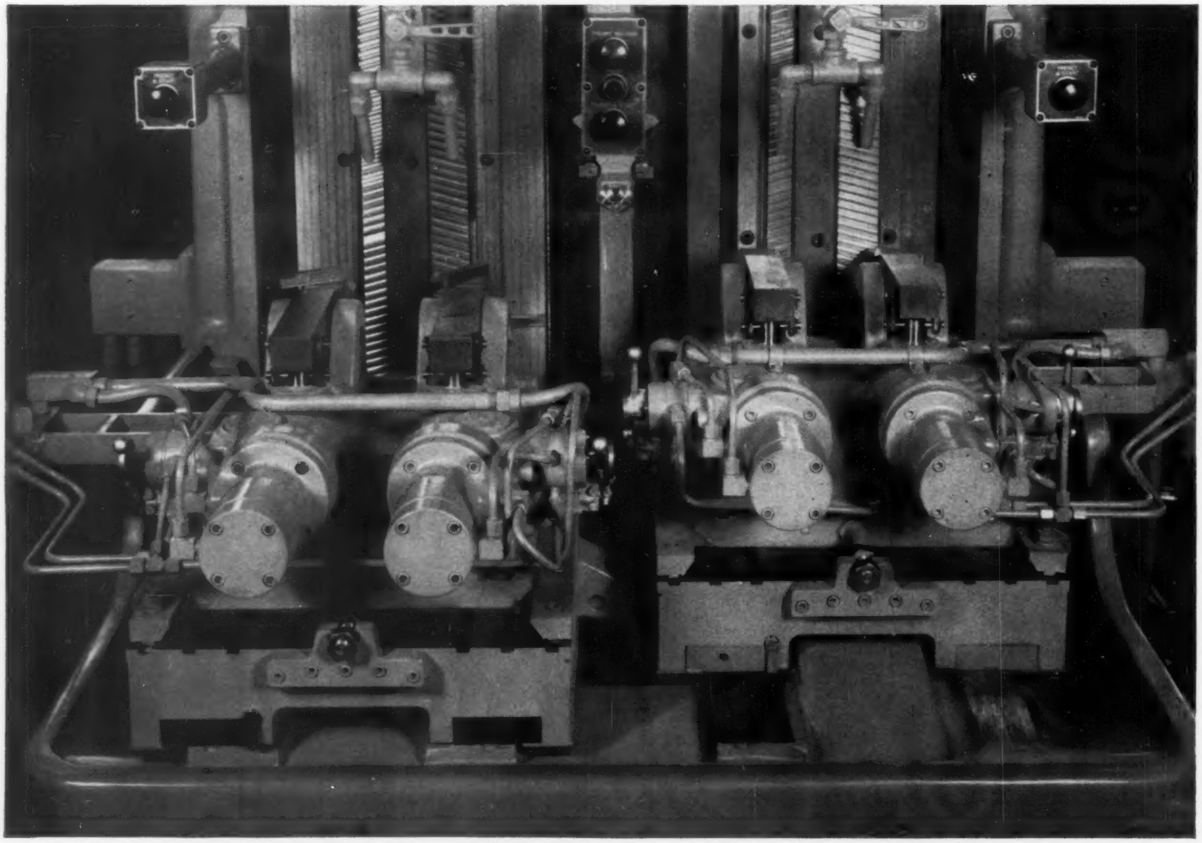
precision disc grinders

BELOIT, WISCONSIN



Two tool bits clamped in position, as seen by the broaching cutters. The top relief will be broached on one of these blanks and the side relief on the other.

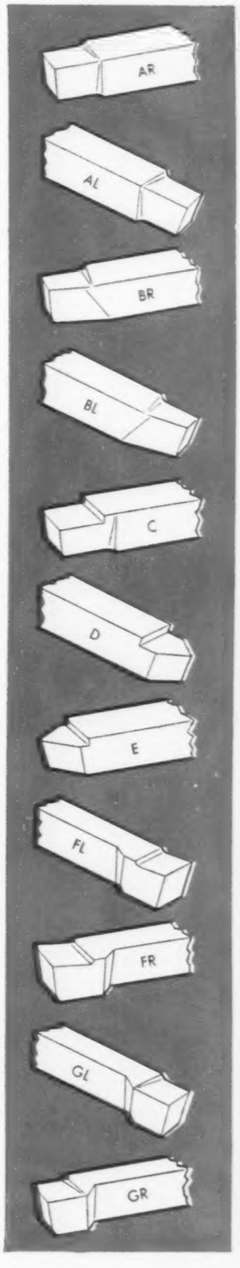
Two Broach in 65%



Cincinnatis

134 SIZES of Tool Bits

Less Floor Space



Doing more work in a smaller area releases valuable floor space for other productive equipment; reduces fixed cost. Two CINCINNATI® Hydro-Broach Machines save 65% of the floor space formerly required by the old equipment to machine 11 styles of tool bits in 134 sizes. These two Hydro-Broach machines, both of 10-ton capacity, were tooled up by Cincinnati broaching specialists with hydraulically operated, progressive type fixtures. All tool bits, a few of which are illustrated at the right, are broached complete from a common shape of blank.

This Cincinnati two-machine production team averages 800 completely broached parts per hour.

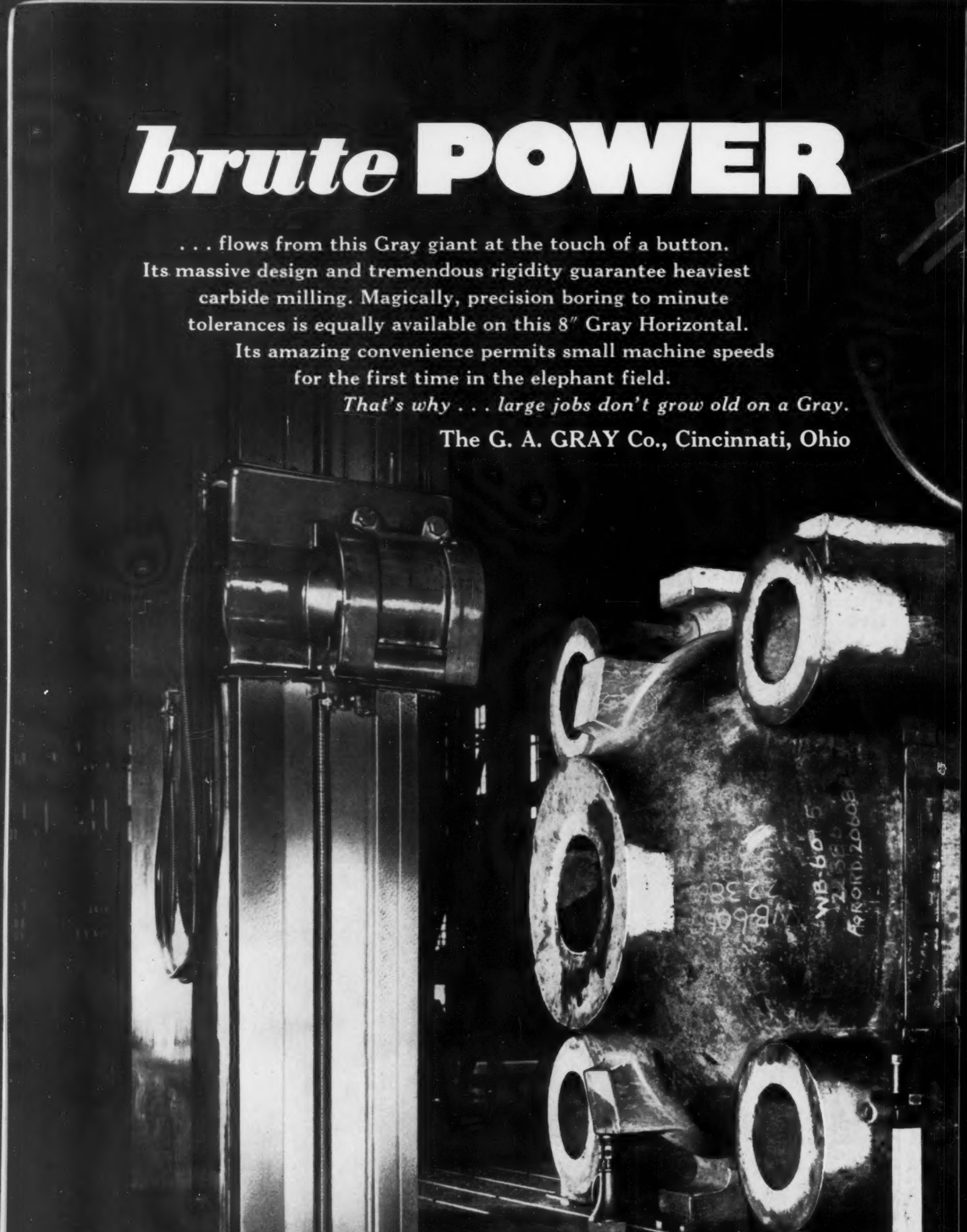
You may not be directly interested in the manufacture of tool bits, but you will be interested in what CINCINNATI Broaching Machines and Engineering Service can do to reduce your manufacturing costs (and perhaps fixed costs, too). May we hear from you? Meanwhile, you might want a copy of our latest Duplex Hydro-Broach catalog. Brief specs will be found in Sweet's.

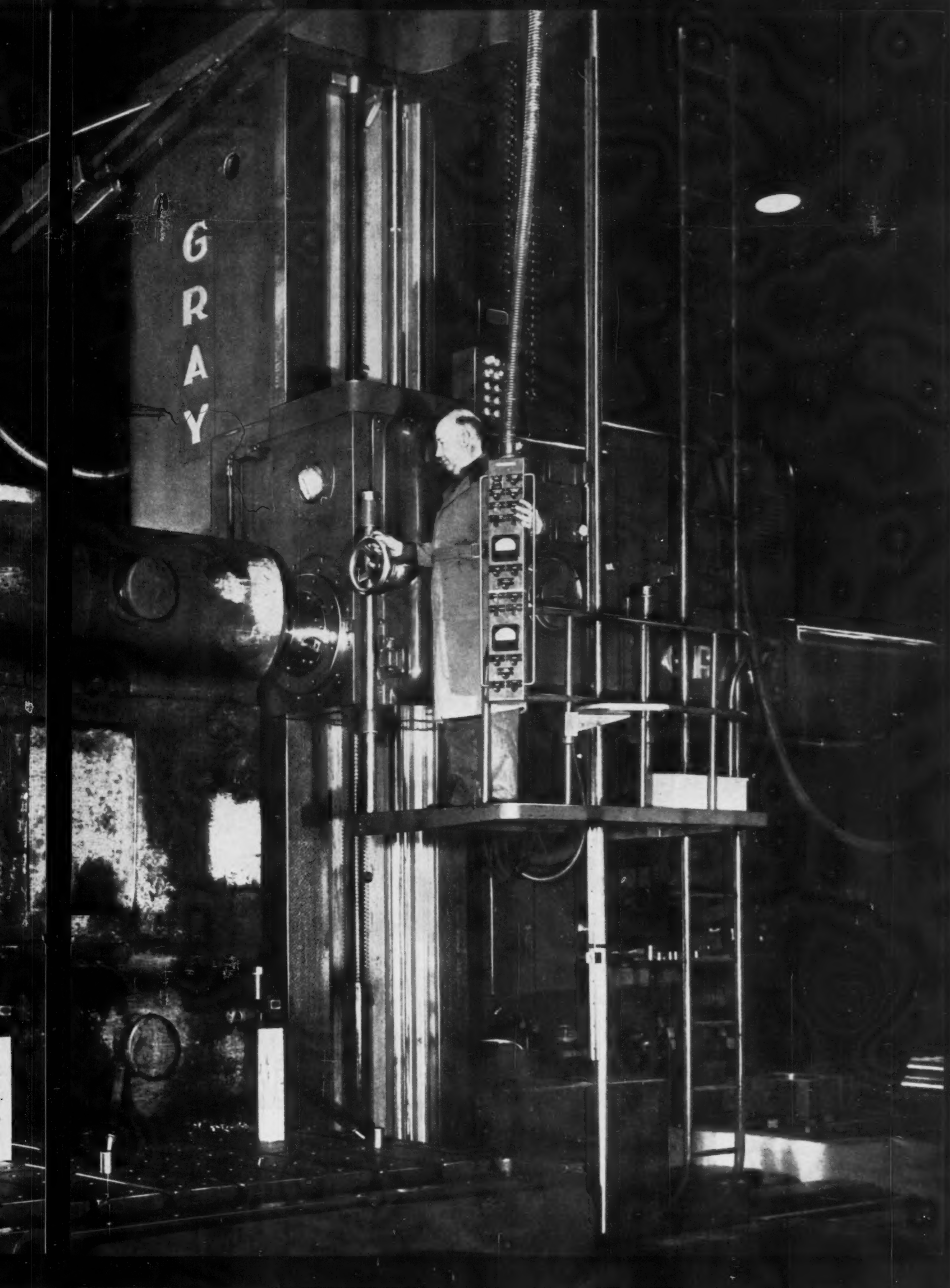
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

CINCINNATI

MILLING MACHINES • BROACHING MACHINES • CUTTER AND TOOL GRINDERS • METAL FORMING MACHINES
HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID • GRINDING WHEELS

For more information fill in page number on Inquiry Card, on page 223


brute POWER
. . . flows from this Gray giant at the touch of a button.
Its massive design and tremendous rigidity guarantee heaviest carbide milling. Magically, precision boring to minute tolerances is equally available on this 8″ Gray Horizontal. Its amazing convenience permits small machine speeds for the first time in the elephant field.
That's why . . . large jobs don't grow old on a Gray.
The G. A. GRAY Co., Cincinnati, Ohio


GRAY

ERGONOMICS

"designs" the operator into all Warner & Swasey Turret Lathes

Result: Increased Production

ERGONOMICS—today's new science of designing machines for their easiest and best use by the operator—has been the very basis of Warner & Swasey design for over 75 years. It's a *new word* in the industrial dictionary, but a *long-accepted idea* here.

Warner & Swasey designers know that maximum lathe production is obtained only when operators like the equipment with which they work. So, by taking into account human abilities and limitations, they "ergonomically" design turret lathes which provide you:

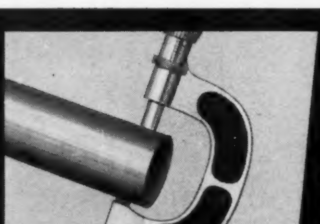
Zoned Operating Controls for effortless machine handling together with full power-holding devices and automatic headstocks.

Accurate Machines for worriless production over a long period of time with minimum maintenance.

Individually designed machine sizes and types so the machine is neither too big nor too small for the job range.

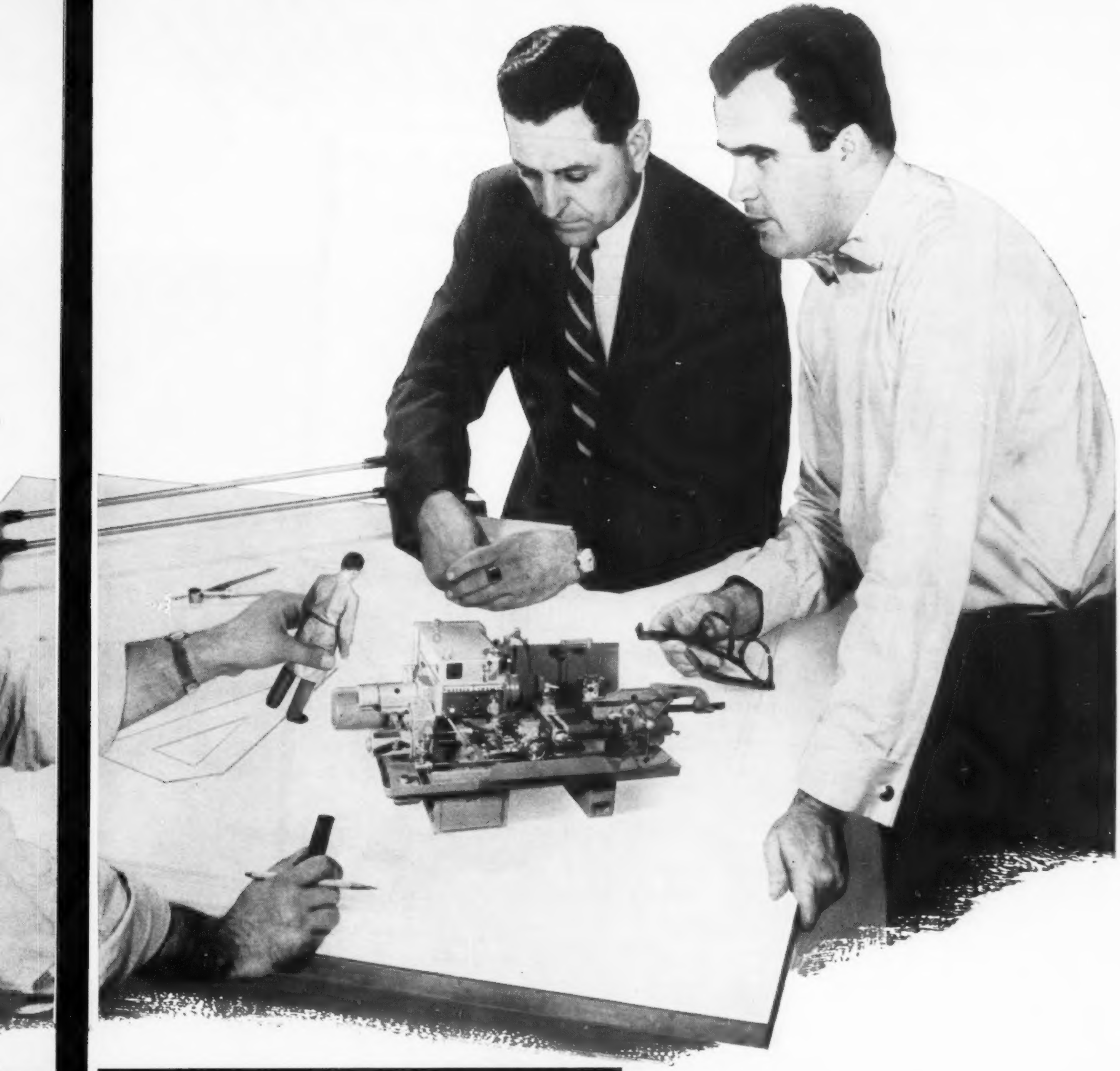
Operators are more content, their output increases and best of all, *your* profits rise when you put Warner & Swaseys on the job.

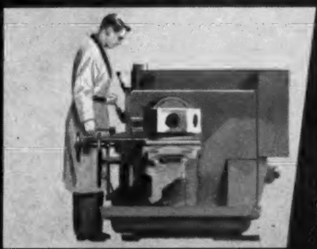
The direction in which an operator must move a lever has an important bearing on the strain involved and speed of accomplishment.



Accurate machines put relaxation and enjoyment into your operator's work day...eliminating the constant fight to hold tolerances and avoid scrap.

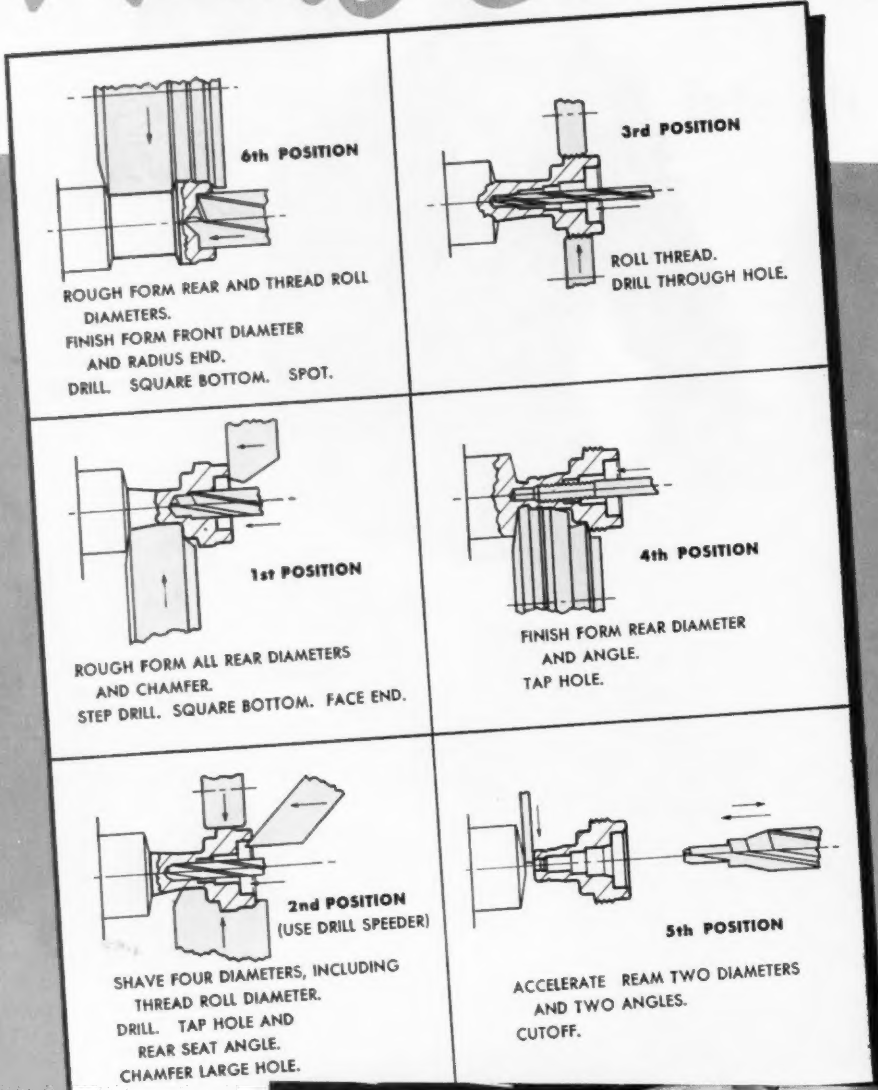
YOU CAN PRODUCE IT BETTER,





For more information fill in page number on Inquiry Card, on page 223

Acme-Gridley



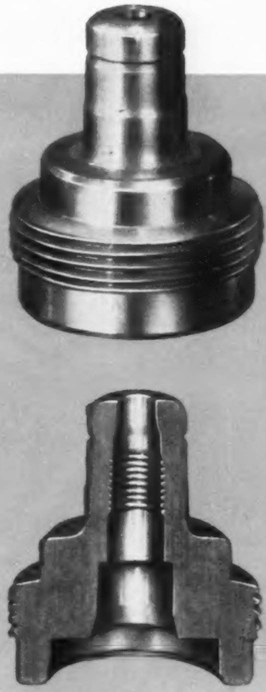
The operator, Clarence Tyler, also is happy with his Acme-Gridley. Tooled to complete one piece every 11¾ seconds, the machine can maintain that speed for as long as 16 hours before it is necessary to regrind tools.

gives NESS, INC. important production bonuses

Purchased primarily to eliminate secondary operations, this Acme-Gridley Six Spindle Bar Automatic has given a good account of itself in many other ways.

Says G. C. Pfrengle, General Manager of NESS, INC., "This 1¼" Acme-Gridley Six Spindle Automatic came into the shop and immediately went into production, without an extended 'get acquainted period'—notwithstanding the fact that we had not run this type of automatic previously. It has been completely satisfactory; we are especially pleased with the tool life and stability of the machine, which has resulted in a minimum of down time. And, since we are able to complete the part without secondary operations, costing is improved."

Owners of Acme-Gridleys will recognize immediately that the *"tool life and stability of the machine,"* about which Mr. Pfrengle comments, is the result of plenty of "beef", properly distributed—a basic design principle of all Acme-Gridleys.



JOB FACTS

PRODUCED BY: Ness, Inc., multiple operation specialists in the production of automatic screw machine products, emphasizing close tolerances.

PART..................Bushing
MATERIAL...........B-1113 Steel
MACHINE TIME..... 11¾ Seconds
NUMBER OF OPERATIONS..... 14

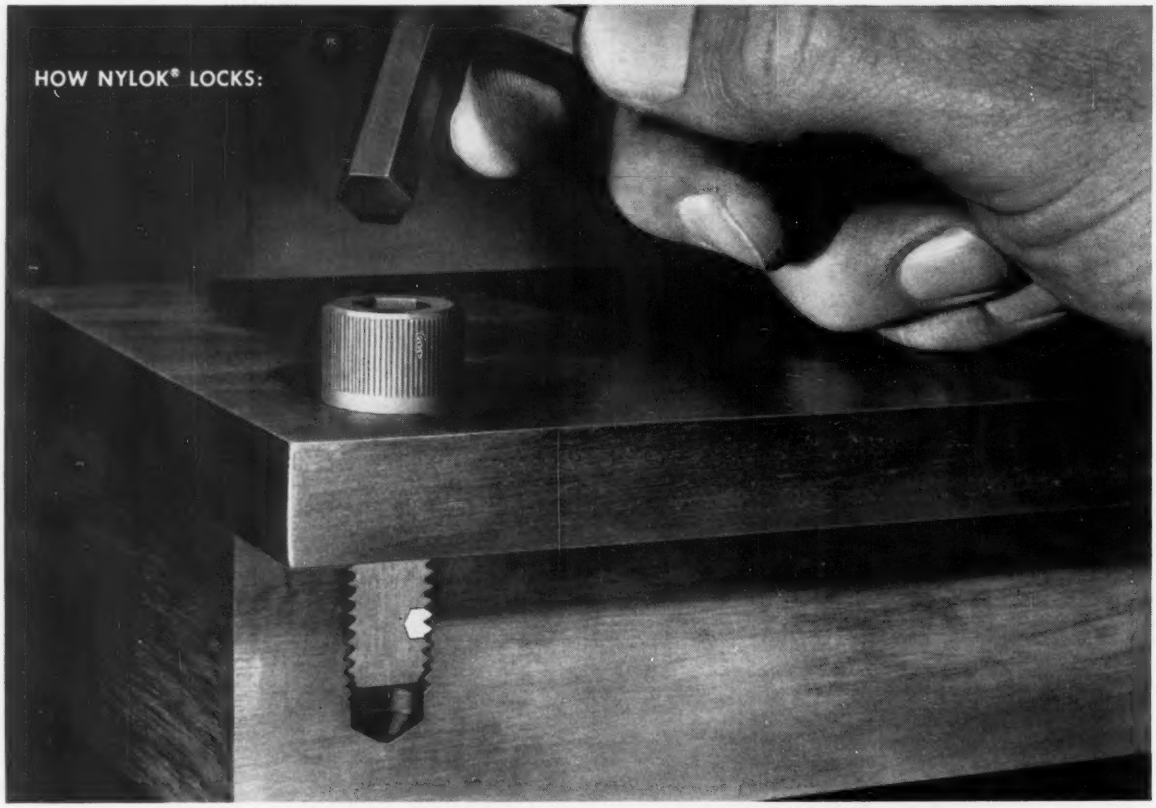
INDEX... to lower machining costs... with *Acme-Gridley* **CONTROLLED CYCLE**

National Acme

THE NATIONAL ACME CO.
179 EAST 131ST STREET
CLEVELAND 8, OHIO

Sales Offices... Newark, N. J.... Detroit, Mich.... Chicago, Ill.

For more information fill in page number on Inquiry Card, on page 223



LOCKED! The tough, resilient nylon pellet keys itself into the mating threads. It forces threads together, and locks the screw securely.

NEW—a complete line of self-locking UNBRAKO socket screw products that won't work loose

They simplify design and save production time

UNBRAKO socket screws are now available embodying the Nylok self-locking principle. Nylok provides a truly practical new solution to the problem of making screws self-locking.

You save production time when you build products with self-locking UNBRAKOs. And you get greater simplicity in design with less bulk and weight. The number of parts you must assemble to achieve full locking action is reduced to the absolute minimum. Lockwashers under screw heads are no longer necessary. Costly wiring of cross drilled heads is eliminated. So are cotter pins and complex multiple set screw installations.

Self-Locking UNBRAKOs are completely reusable. They have uniform locking and installation torques—with no galling or seizing on mating threads. They successfully withstand temperatures from —70° to 250°F. And, on properly seated screws, the pellet acts as a liquid seal.

Self-locking UNBRAKO socket screws come in a complete range of standard sizes and materials. See your authorized industrial distributor. Technical data and specifications are detailed in Bulletin 2193. Write us for your copy today. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

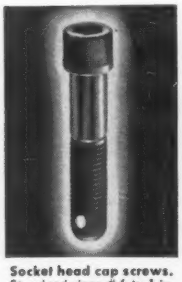
We also manufacture precision titanium fasteners. Write for free booklet.

UNBRAKO SOCKET SCREW DIVISION

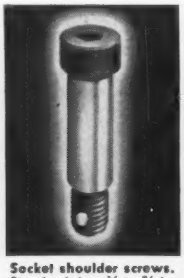
STANDARD PRESSED STEEL CO.

SPS

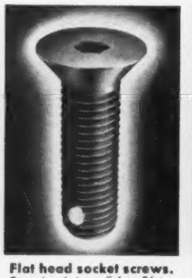
JENKINTOWN PENNSYLVANIA



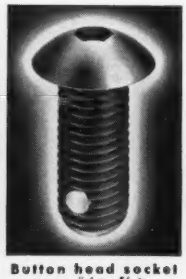
Socket head cap screws. Standard sizes #6 to 1 in.



Socket shoulder screws. Standard sizes ¼ to ¾ in.



Flat head socket screws. Standard sizes #6 to ¾ in.



Button head socket screws. #6 to ⅝ in.

Socket pressure plugs. Standard sizes ⅛ to 1¼ in.

Socket set screws. All standard point types. #6 to 1 in.

For more information fill in page number on Inquiry Card, on page 223

Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Presented as a service to production men, we hope some of these interesting ideas, chosen from thousands of jobs, will suggest ways to help cut time and costs in your own work.

NEW HIGH-SPEED AUTOMATIC THREADING ATTACHMENT SAVES TIME

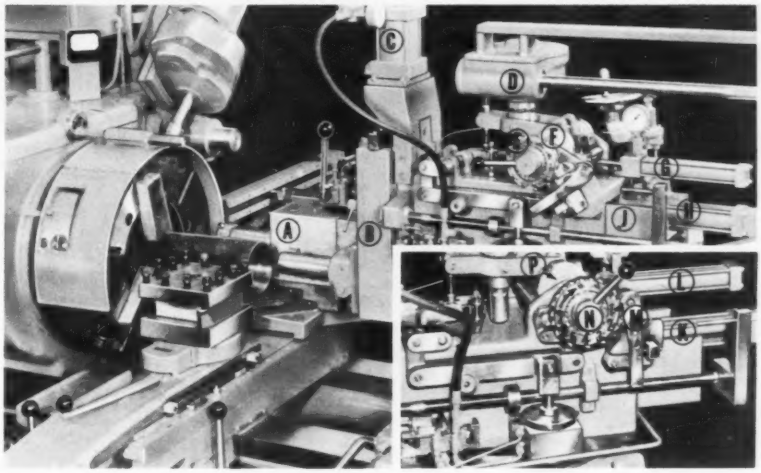
Handles full range of sizes on "Extremeline" oil well casing pipes with minimum change-over

After you've studied this setup, you'll see why it's termed a "cost-cutter" for manufacturers of oil well drill pipe and casings. With it, both I.D. and O.D. threading operations are held to high accuracy—using an automatic repeating thread-chasing slide attachment, mounted on the hexagon turret of a 4L Saddle Type Turret Lathe.

Here's the operation for box ends of "Extremeline" casings, in 8 sizes from 5″ to 9⅝″ O.D.: Each casing is loaded through the spindle and held by 2 power chucks at the front and rear. Hex turret tools clean up the straight bore, chamfer the I.D. and shave-face the end, while front square turret tools chamfer the O.D. and face to length.

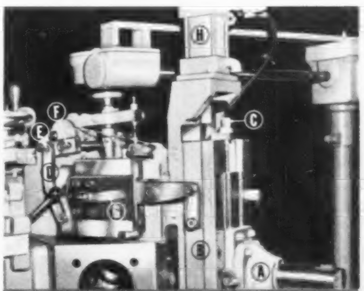
In 2 passes, a JETracer on the rear of the bridge-type cross-slide rough- and finish-contour bores the I.D., indexing a finishing tool on the boring bar into position for the second pass. Using a dial indicator, the hexagon turret carriage is located longitudinally and clamped to the bedways for the threading operation. With gearing off the feed drive shaft driving the threading slide—and change gears providing correct feed for different pitch threads on various part sizes—several fast, automatic passes from the thread-chasing slide attachment complete the part.

For the 7⅝″ part shown, f.t.f. time is 10 min. Simple, fast-moving lightweight slide carries threading tool, saves time on repeat passes. Setup eliminates cost of automatic die-heads, upkeep and replacement of expensive chasers.

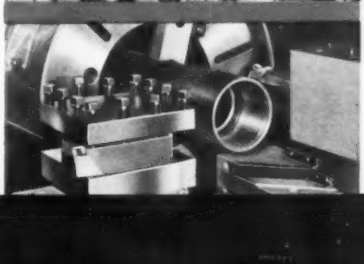


▲ Tooling setup for machining box end of 7⅝″ "Extremeline" casing. Here's a typical threading cycle. Clutch D engages; horizontal slide J moves forward carrying vertical slide B and chasing tool A into work. At end of stroke, clutch D disengages and air cylinder H returns slide J. Cylinder C provides follow-up on vertical slide B, eliminates backlash, forces slide to drop at end of pass, relieving tool. On return of slide, stop screw K hits trigger M (inset) releasing escapement wheel N, permitting cam P to be rotated by cylinder L, increasing depth of cut. As full form of thread is engaged, cuts are more shallow. This is governed by decreasing distance between teeth 1, 2, 3, 4, etc., until finished depth is reached. Last 3 passes taken at same depth to clean up cut and compensate for spring in tooling or thin wall of casing.

Change-over for various sizes and I.D. or O.D. threading operations is fast, simple. Flanged tool holder A is set anywhere along T-slots of vertical slide B for various diameters. Micrometer screw C provides final size adjustment. Cam plate G governs path of threading tool for straight or tapered threads in bore on the box end of casings. For external threading on the mating pin ends, cam plate G is reversed, cutter is moved under bar, tool holder A is raised, link D is moved from stud E to F and cylinder H connections are reversed, pulling threading tool up for relief at end of cut. ▶



Finished threads in box end of "Extremeline" casing. Note JETracer tool behind work, not interfering with threading or normal machining operations. Threading slide tool meets "Extremeline" casing thread tolerances with ease, both in lead and thread form. ▶



MASTERLINE
GISHOLT SINCE 1887

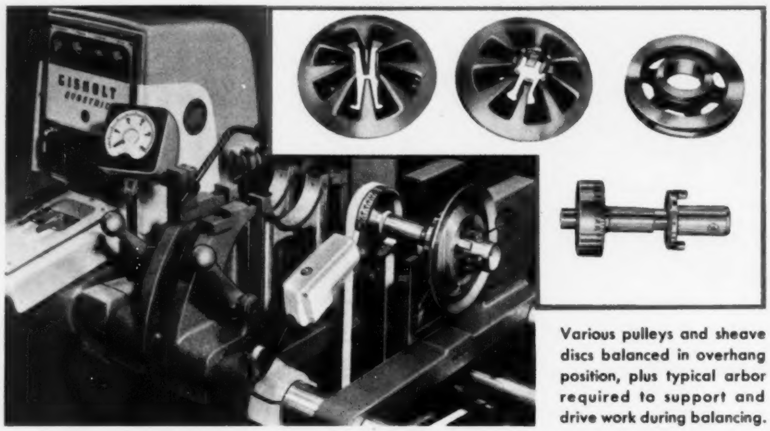
TIME-SAVING IDEAS

HOW TO SIMPLIFY JOB-LOT BALANCING

Get economical operation from quick setup and wide capacity of 31S Balancer

This balancing setup reveals how a leading producer handles job-lot parts economically on short production runs.

Workpieces include several sizes of pulley and sheave discs. A 31S General-Purpose Balancer gives high accuracy at low cost. With both lightweight and heavyweight work supports, the 31S handles parts from 2 to 300 pounds. Setup is very fast, and the direct reading amount meter is quickly calibrated to indicate exact unbalance amounts—in terms of correction method used for each part being balanced.



Various pulleys and sheave discs balanced in overhang position, plus typical arbor required to support and drive work during balancing.

▲ Close-up of 31S. Weight capacity of work supports at left is 15 to 300 pounds, at right from 2 to 50 pounds (which includes pulleys and sheave discs shown above). Note spring-loaded ball A, which saves time, eliminating need for clamping nut.

Here's a setup for single-plane balancing. The parts do not have their own shafts, so a balancing arbor is used. With the arbor placed between the work supports, the workpieces are slipped on the end and balanced on the overhang, eliminating need to lift belt and remove arbor for each part. Location is against a shoulder on the arbor, and drive is from a pin engaging an opening in the backside of the part. Parts are held axially by a spring-loaded ball (A), which depresses as the part goes on the arbor, pops up as it locates against the shoulder, and bears against the edge of the bore to hold the part securely on during rotation.

The amount meter indicates the precise amount of unbalance, and the strobe lamp shows the exac. angle of location. The operator marks the workpiece and amount of correction needed, then makes the correction on a drill press to complete the job.

The versatile 31S reduces the balancing time on these parts, assures complete accuracy, eliminates guesswork. Wide capacity and flexibility of operation make this machine ideal for contract work or short production runs.

TRIMS PISTON FINISHING TIME 25% BY SUPERFINISHING

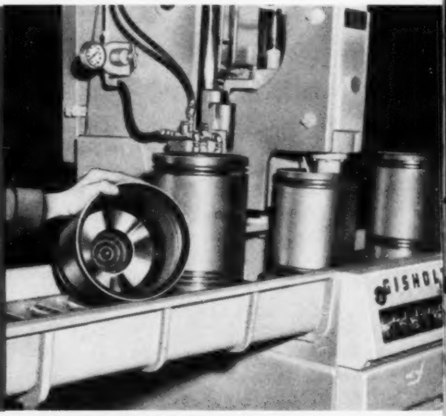
Handles two different sizes on Model 81 Superfinisher without change-over

Have you considered Superfinishing flat surfaces in your production setup? If not, you might want to read how a leading manufacturer is using this most modern process—to save time and obtain finer finish on the sealing faces of large cast iron floating pistons for diesel engines. A Gisholt MASTERLINE No. 81 Single-Spindle Superfinisher is doing the job.

A special Superfinishing quill unit handles 2 different sizes of pistons, which come through the machine on a conveyor, in random order. Here's how easy it is for the operator: he simply notes the type of the piston and presses the correct button, which automatically moves the Superfinishing stone to the exact depth required. Still greater efficiency is realized by using the same stone and cycle for both part types.

Placed on a special rotating fixture, the piston is held and driven from the base end. The automatic rough-and-

Overhead view shows cup wheel lowered to Superfinish sealing face of diesel piston.



Model 81 Superfinisher with in-and-out conveyor. Part on left tilted to show Superfinished surface.

finish Superfinishing cycle completes 24 pieces per hour, at 80% efficiency. Surface roughness is reduced from 100 micro-inches R.M.S. to 32 or less on each part.

Time is saved, cost of extra equipment eliminated by one Superfinishing unit tooled for both part types. High production is achieved with minimum operator attention. Smoother surface gives longer wear life.

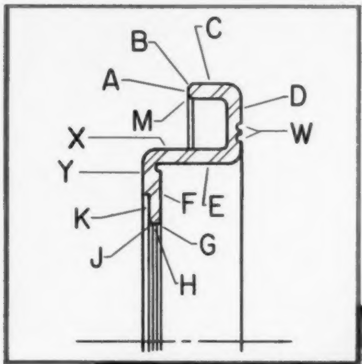
GISHOLT

GISHOLT

TIME-SAVING IDEAS

MACHINES 14 PART SIZES AUTOMATICALLY

Lowers time, sharpens accuracy with Lynn Drive on No. 3 Ram



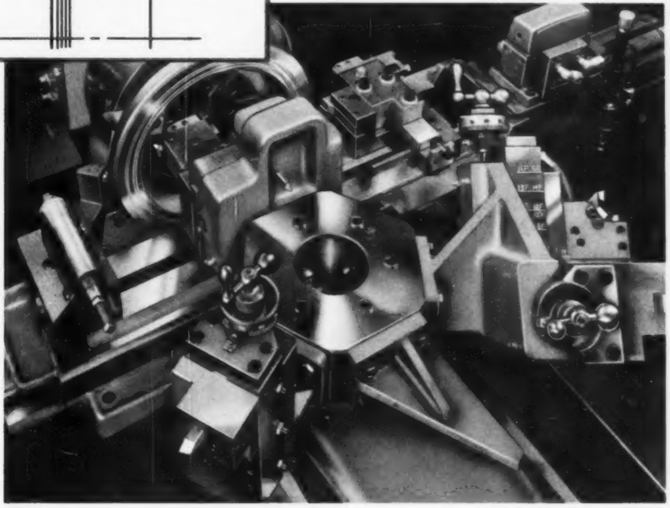
Machining odd-shaped parts in your plant? You might find some profitable ideas in the way this manufacturer is handling 14 sizes of steel stampings, using the No. 3 Ram Type Turret Lathe equipped with Lynn Hydraulic Drive.

Typical cycle on largest part handled ($15\frac{1}{4}''$ diam.) is as follows: A 3-jaw, $12''$ air chuck holds the work at X, locating at Y. An airdraulic unit on the rear of the bridge-type cross-slide feeds a special rear tool block and actuates turret-mounted sliding tool holder (shown in working position), simultaneously facing A-D-F-K and chamfering J.

The next turret station turns C, bores E-H, chamfers G. Tooling on the final turret station grooves W, while front cross-slide tools break the sharp corners at M-B. F.t.f. time is only 3.30 min.

Adjustable tooling handles all sizes from $3\frac{3}{4}''$ to $15\frac{3}{4}''$ diam. and $\frac{7}{8}''$ to $2\frac{15}{16}''$ width, with minimum changeover. Boring bars are arranged so they can be placed between centers, permitting boring and co-boring tools to be set in tool room, using dial indicators. Remaining tools have backing screws, and tool blocks are cross-keyed for pre-setting. For various size parts, chuck jaws are changed or jaw inserts added or removed.

With low initial investment, wide varieties of shapes and sizes are handled automatically through smart tooling plus Lynn Drive. Automatic cycle on ram lets operator handle extra units or perform other work.



Adjustable tooling handles 14 work sizes. Special adjustable slide tool at right has scale etched on block to speed adjustment to various sizes.

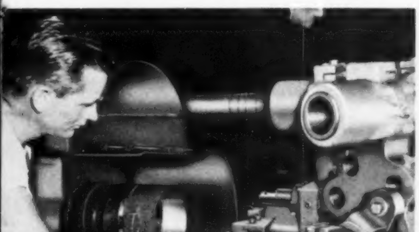
MASTER ELECTRIC CO. SPEEDS PRODUCTION WITH 50 FASTERMATICS

Fast setup, automatic cycle ideal for short runs on electric motor parts

Talk about profitable operations! This job reveals how Master Electric Co., Dayton, O., completes over 150 motors per hour—using more than 50 1F and 2F Fastermatic Automatic Turret Lathes. The operation involves motor frames, gear covers, end bells, bearing housings, parallel heads, vapor-proof heads, etc.

The setup you see here, on cast iron motor frames, shows how this user gets the most from his Fastermatics. One operator handles 4 machines, with 3 of them double-tooled to perform first machining operations on 3 different part sizes. Facing, boring and chamfering are performed in $3\frac{1}{2}$ minutes f.t.f. Each complete cycle of the hexagon turret produces 2 motor frames.

Triple-tooling on the fourth Fastermatic handles the second machining operation on all 3 sizes as they come from the other 3 machines. Two stations are used for each size to finish the bore, face and chamfer. The cycle then stops; the operator removes the part, slips a spacer on the mandrel, and inserts the next size workpiece. The cycle then repeats, with f.t.f. time for the second operation held to just 1.5 minutes.



First operation on cast iron motor frame, showing workpiece and tooling. Three stations complete part. Double-tooled turret provides 2 parts for each complete index.

Second operation. Note spacer which compensates for changes in width. Turret is triple-tooled to let each complete index finish 3 different part sizes.

Complete automatic cycle of Fastermatic lets single operator handle multiple units, holding consistent high production and accuracy and using no more setup time than with hand-operated lathes. Automatic cycle means more time cutting chips, more output, less unit cost.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

AiResearch SAVES ON TURBINE WHEEL PARTS BY USING JETracer

No. 12 Automatic Production Lathe, 4-pass JETracer, variable-speed drive motor combine to reduce costs and improve quality

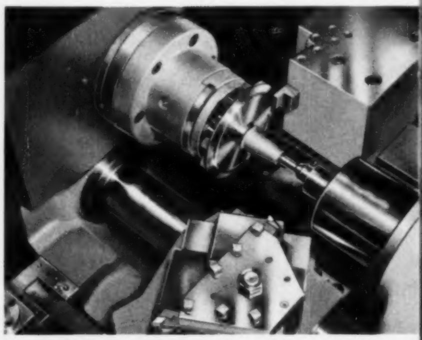
You'll spot planning behind this job—at the Garrett Corporation's AiResearch Manufacturing Division, Phoenix, Ariz. Here, contour-facing and stepped-shaft turning operations are combined to produce steel turbine wheels in rock-bottom f.t.f. time.

To maintain constant surface footage and assure reasonable tool life when changing from turning to contour-facing operations on the same part, AiResearch is using a Gisholt MASTERLINE No. 12 with a 4-pass JETracer and a variable-speed drive motor. The workpiece is 6½″ in diameter and 4¼″ long.

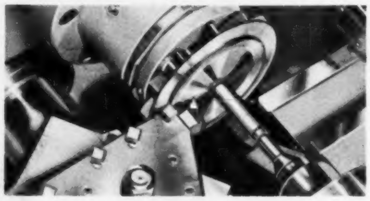
Parts arrive cut to length and centered. Distance between centers is held for location. A spindle-mounted compensating work driver with a built-in adjustable center holds the work at one end, and a tailstock center supports the other end. Drive is by a stud against the impeller vanes on the backside of the part. Before tracing begins, 2 tools on the rear independent slide rough-face. Then the JETracer, using a 4-position indexing template-carrying drum, rough-turns the shaft and rough-contour-faces the work in 3 fast, automatic passes. Spindle speed during machining is governed by a special cam on the JETracer slide. A finishing tool automatically indexes into position on the fourth and final pass, and the JETracer completes the part.

Part is finished in 6.5 min. f.t.f. Variable-speed drive motor maintains finish of less than 250 micro-inches on all surfaces. Complete automatic cycle prevents operator fatigue and human error on tricky contour-machining operation.

Finishing tool making finishing cut, completing part. Note uniform surface finish through JETracer and variable-speed motor arrangement.



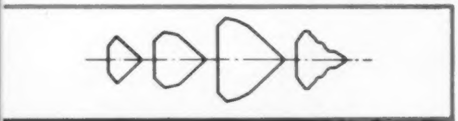
Work and tooling shown after rough-facing from rear independent slide. Note considerable stock to be removed on step-shaft and face of part.

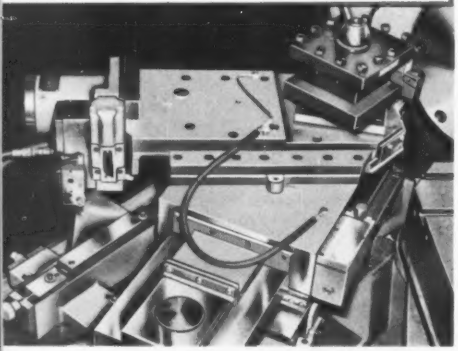


Ask for new Catalog No. 1171-A, giving complete information on JETracer applications on various MASTERLINE machines.

CUTS F.T.F. TIME WITH JETracer ON SIMPLIMATIC

JETracer on independent slide machines oil well drill cone forgings more accurately





JETracer on independent slide of Simplimatic.

Here's one way to add considerable tooling flexibility to the MASTERLINE Simplimatic Automatic Lathe. Single- or multiple-pass independent JETracer slides may now be mounted on the flat platen table. Along with other standard slides, it operates within the automatic machining cycle. In all cases, the template carrier is located underneath and to the rear of the JETracer slide, with longitudinal and transverse adjustment provided for each template.

This single-pass setup generates all the different angles on the front faces of a variety of steel oil well drill cone forgings, while rear slide tools face the back angle. Several pre-set tools are carried on the indexing turret. When one becomes worn, a fresh tool is indexed into position, minimizing down time during the production run. A variable-speed motor, governed by movement of the JETracer slide, provides a constant surface speed for a fine finish. A similar setup on another machine uses the JETracer slide to generate the angles and rough out the grooves, as shown in the line drawing at the left.

Three typical parts handled with JETracer slide in photograph. Part on far right handled in a similar setup where independent JETracer slide generates angles and roughs out the grooves.

JETracer on Simplimatic improves accuracy, saves time. Typical 8½″ drill cone is finished in only 1.90 min. floor-to-floor time.

No. 7-857
683

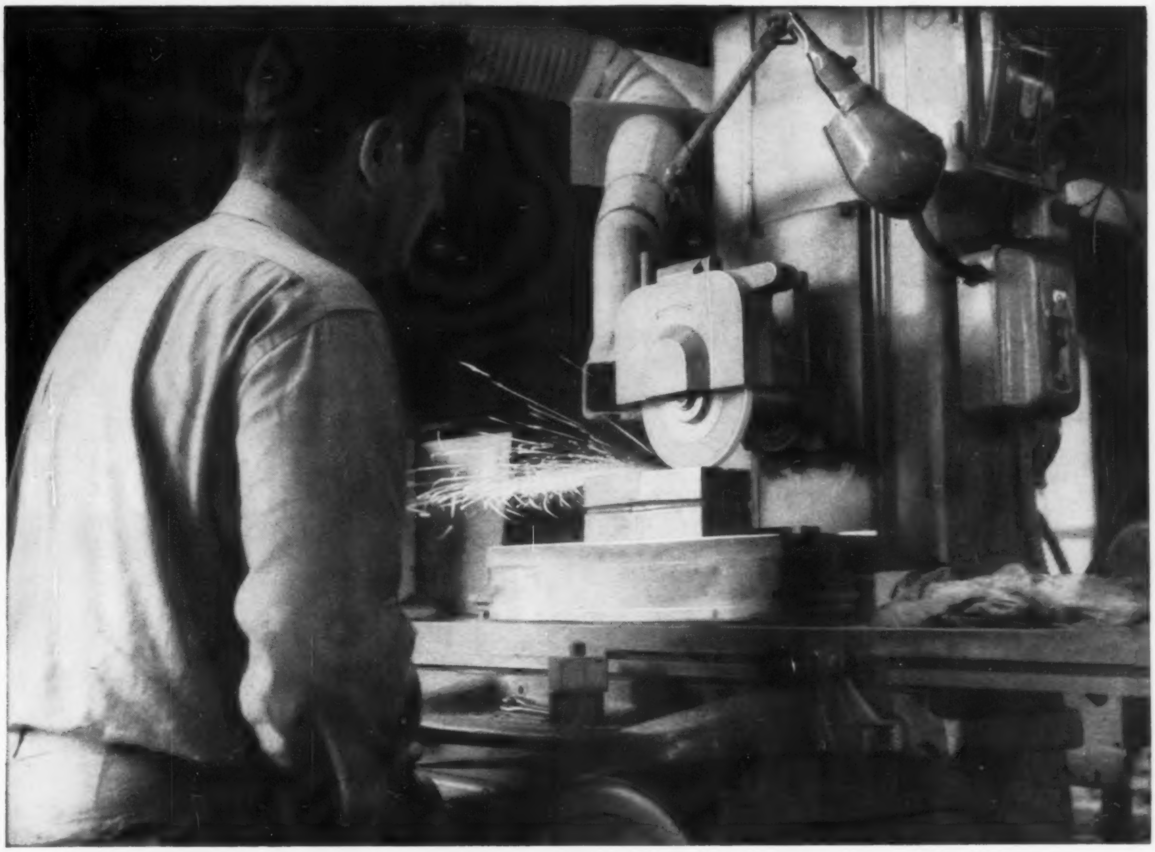
GISHOLT

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

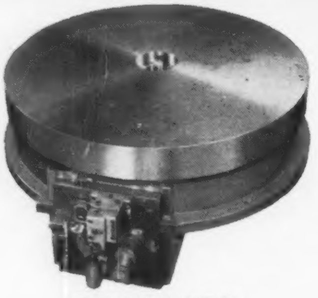
GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



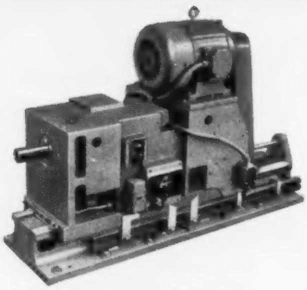
For more information fill in page number on Inquiry Card, on page 223

BECAUSE MAJOR COMPONENTS



STANDARD
ROTARY INDEX TABLE

available in 4 different table diameters, any practical number of indexes . . . permits use of a variety of work-holding fixtures . . . adapts to other machine designs.



STANDARD
WAY-TYPE DRILL UNIT

for drilling, boring, reaming, counter-boring and chamfering. Single and multiple spindle arrangements, single or double feed rates.

KEARNEY & TRECKER TAKES OF PRODUCTION

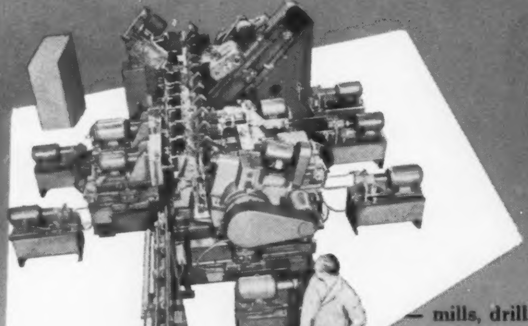
Here's a sound, proven *economical* approach to your production machine tool problems... Kearney & Trecker production machine tools featuring standardized components.

You get IMPORTANT SAVINGS — benefit directly three ways: (1) lower initial cost; (2) less lead time needed and (3) proven standard units mean efficiency *plus* simplified maintenance.

Ask the Kearney & Trecker man — he'll show you more examples of standardized machine components in production machine tools — the keys to capturing more profits from production!

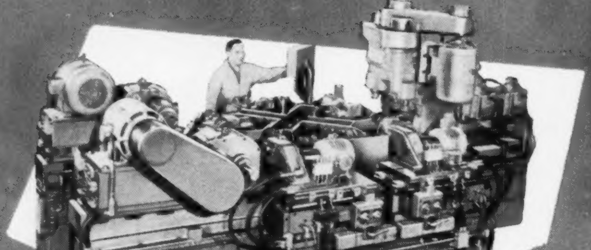
Integrated standard components meet

THIRTEEN STATION AUTOMATIC TRANSFER MACHINE



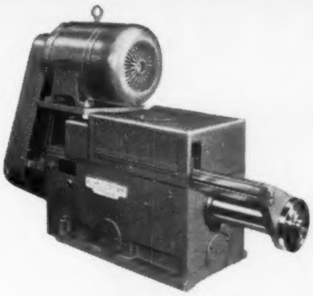
— mills, drills, reams, spot-faces, taps and saws apart cast iron bearing cap blocks. Machine includes 5 standard feed slides and standard production units.

FOUR STATION ROTARY TRANSFER MACHINE



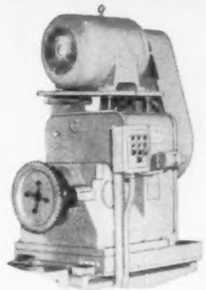
— New rotary transfer design permits machine to mill and center drill the ends and mill locating notches on crankshafts. Four standard feed slides, 3 standard production units are used.

ARE STANDARDIZED . . .



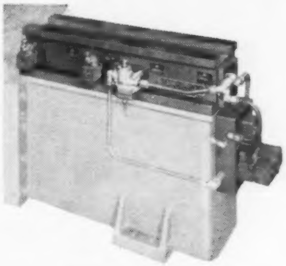
STANDARD QUILL FEED UNIT

for drilling, boring, reaming, spot-facing, counter-boring, chamfering. Single or multiple spindle arrangements — single or double feed rates.



STANDARD MILLING HEAD UNIT

4 sizes. Single spindle . . . various horsepower and speed ranges . . . Single or double reduction drive . . . automatic quill retraction. Any size can be modified for boring.



STANDARD FEED SLIDE UNIT

provides hydraulic feed for milling, boring or drilling heads. Available in four sizes; various length cylinder strokes.

THE "SPECIAL COSTS" OUT MACHINE TOOLS

ASK FOR FREE KEARNEY & TRECKER
Production Machine Tools Bulletin SMD-57.
It provides full standardized component details — and their application to production machine tools.

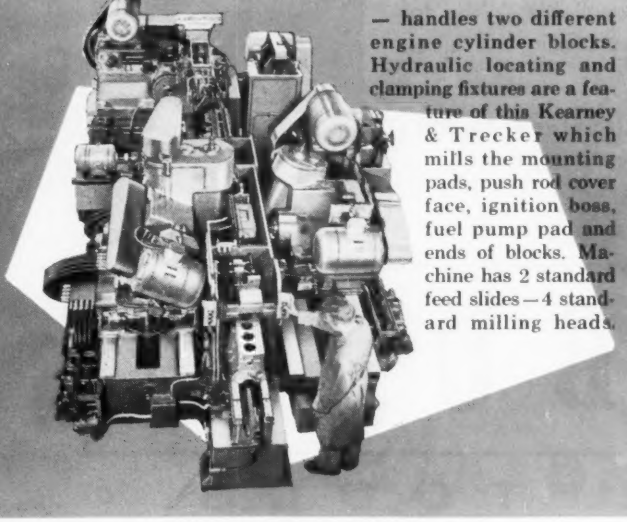
KEARNEY & TRECKER CORP.
6788 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER
MILWAUKEE ®

Designers and Builders of Precision and Production Machine Tools Since 1898

multiple machining requirements

SIX STATION AUTOMATIC TRANSFER MACHINE



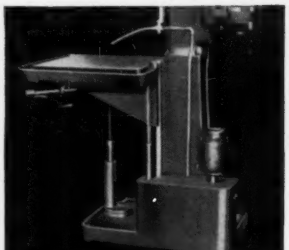
— handles two different engine cylinder blocks. Hydraulic locating and clamping fixtures are a feature of this Kearney & Trecker which mills the mounting pads, push rod cover face, ignition boss, fuel pump pad and ends of blocks. Machine has 2 standard feed slides—4 standard milling heads.

SIX STATION ROTARY INDEXING MACHINE

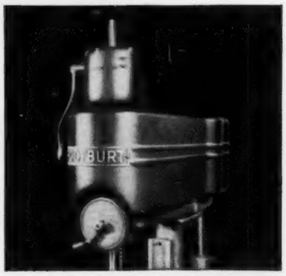
two such machines replaced six obsolete tools for a communications equipment manufacturer. Basically 70% standard, machines incorporate 7 Kearney & Trecker standardized components. Use of overhead hydraulic units saves floor space.

For more information fill in page number on Inquiry Card, on page 223

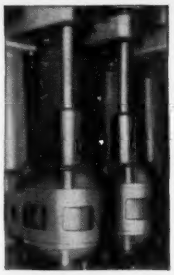
FOOTBURT



No. 2 Machine with Back Gear • 12" Overhang • 5/8" Drilling Capacity in Steel • Optional Speed Ranges • 185 to 2300 RPM • 280 to 3450 RPM • Vertical Motor Drive with Standard Single Speed Motor • Power Feed Assembly • Tapping Attachment • Coolant Outfit.

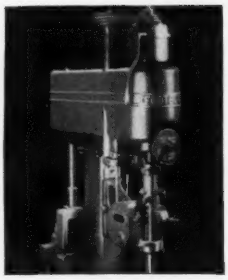


Sensitive drilling machines



A FULL RANGE DRILLING MACHINE ENGINEERED FOR PRODUCTION

Built carefully to provide the required accuracy for fine tool room work, Footburt Sensitives are designed with the weight and stability to maintain close tolerances on day after day production work. The correct speed for a wide range of drilling, reaming, and counter-boring operations is instantly available. Write for full information on this great line of Sensitive Drilling Machines. Built in 1, 2, 3, 4, 6 Spindle Models.



THE FOOTE-BURT COMPANY • Cleveland 8, Ohio

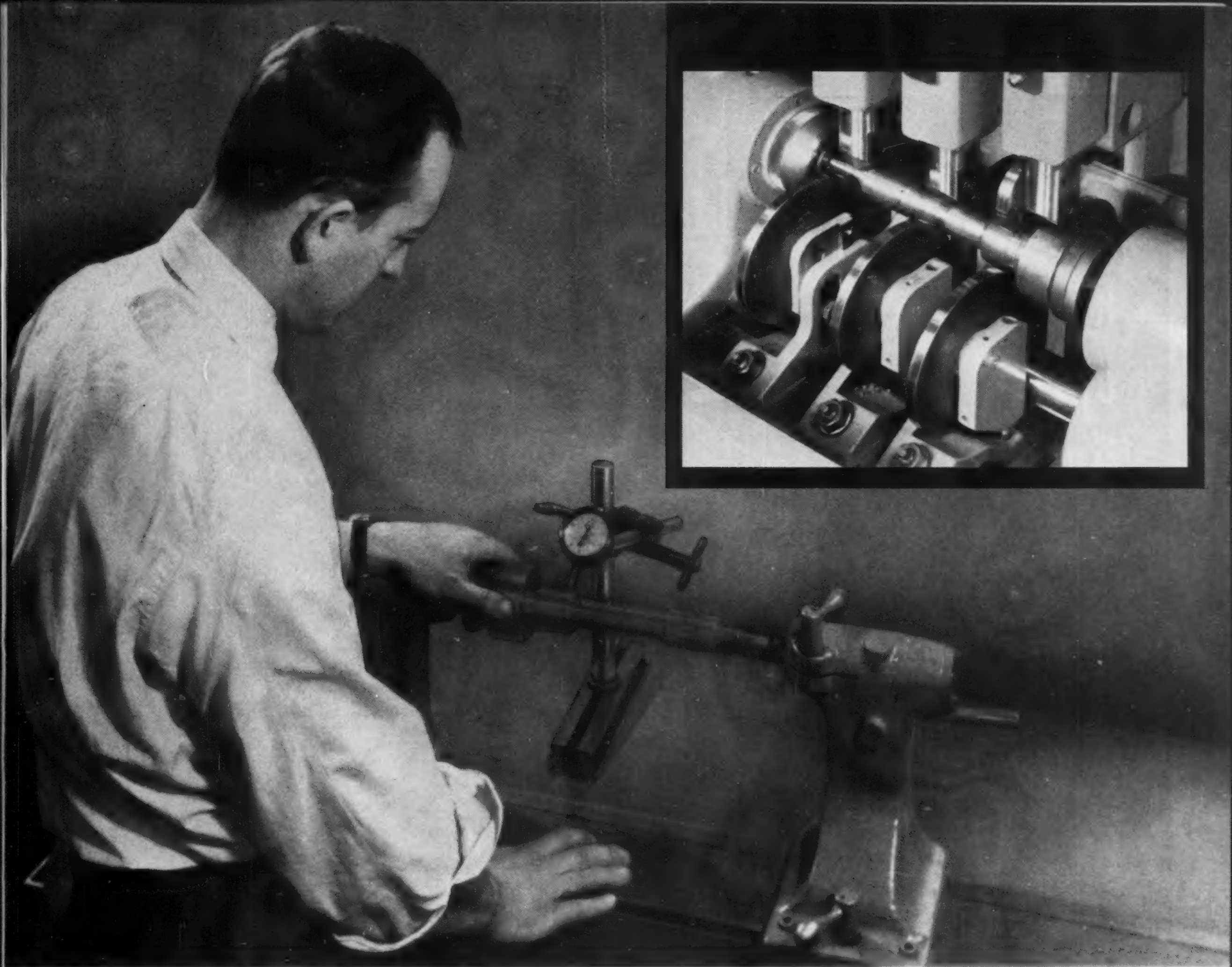
Detroit Office: 24632 Northwestern Highway, Detroit 35, Mich.

ENGINEERED FOR PRODUCTION *Write for Circular #508A.*

FOOTBURT

MACHINE TOOLS

For more information fill in page number on Inquiry Card, on page 223



How this shaft was quenched and straightened *at the same time*

This shaft reads true because it was not allowed to distort during hardening.

The manufacturer used a Gleason No. 140 Rolling Quench Machine to straighten the shaft *while it was being quenched.*

Since cold straightening was completely eliminated, he saved valuable production time and expense.

The quenched shaft also has less residual stress.

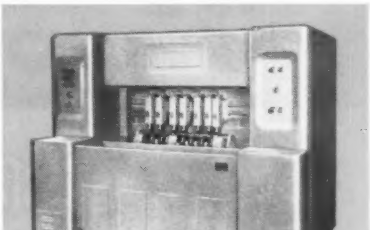
With this machine you roll parts under pressure continuously as you quench them. The operator puts the hot part on the lower rollers and starts the machine.

From there on the operation is automatic. Rolling speed, pressure and oil flow have been pre-set to meet specifications.

The Gleason No. 140 Rolling Quench Machine is suited equally well to both small and large quantity work. It accommodates shafts $\frac{5}{16}''$ to $4''$ in diameter, $6''$ to $40''$ in length, with integral cams or shoulders up to $8''$ diameter.

Tooling can be arranged to hold parts on diameters or centers. Unusual shapes can be handled with additional tooling.

Write for further information.



The Gleason No. 140 Rolling Quench Machine also handles multiple quenching of short shafts.

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N. Y.

65

DIXI 60

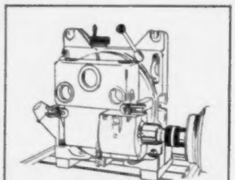
horizontal optical jig borer

The ONLY Horizontal Jig Borer Built Today! Combines the ACCURACY of the Vertical Spindle With the VERSATILITY of the Horizontal Spindle

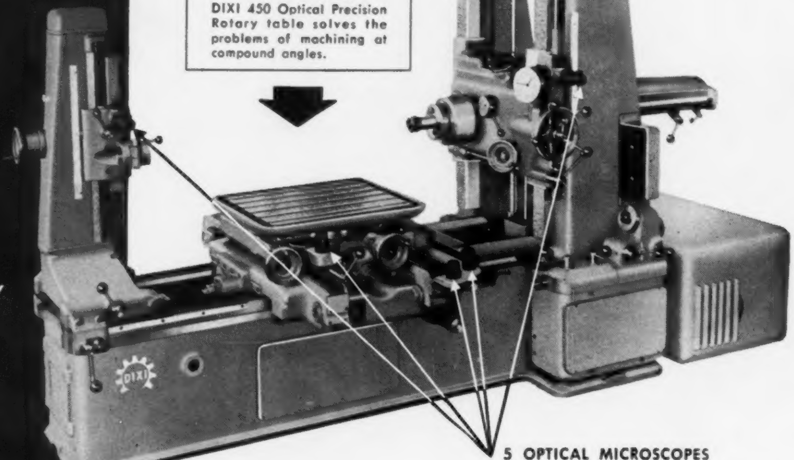
ACCURATE:
Optical settings provide an overall accuracy of .0002.

VERSATILE:
Optical settings for operations in all planes and compound angles . . . equally suitable for tooling, short-run or production work . . . permits JIGLESS boring, facing, milling and drilling.

PRODUCTIVE:
Saves time, labor & costs . . . Unclamping, positioning, fine adjustment, reclamping and rechecking can be made in less than 10 seconds.



DIXI 450 Optical Precision Rotary table solves the problems of machining at compound angles.



The DIXI Optical Reversing Process assures perfect alignment as well as round, taper-free holes. In work pieces with line bores on opposite sides, this is obtained by optically indexing the built-in rotary table 180°, locking the spindle feed and using the hydraulic table in-feed instead. Electrical infinitely variable speed spindle drive; infinitely variable hydraulic feeds; special features eliminate effect of spindle over hang on accuracy.

Made in Switzerland — All measurements in inches

- Guaranteed service by factory trained staff
- Engineering staff available for consultation
- Spare Parts in New York stock
- Your operators trained

DIXI 60 now in wide use in leading aircraft and manufacturing plants throughout the United States.

THIS VERSATILE MACHINE IN OPERATION at our New York, and other conveniently located Demonstration Centers.

Our Headquarters in New York City

MBI

M. B. I.
export & import ltd.

A Division of Machinery Builders, Inc.

475 Grand Concourse, Bronx 51, New York

"Over 25 years experience in designing & building machinery"

Sharpening the blades of 88 blade RIGIDCUT 15 in. diameter cutter. Note the remarkably clean design

WESSON Milling Cutters Show How to Get Top Production, Life

Sometimes the tool itself has to show you what CAN be done.

For instance, take the problem of milling the cylinder block ends for an important CAR ABOUT TO BE ANNOUNCED. To get top results on this job, calculations showed the face milling cutter should be 15 in. diameter and have some 88 blades. Of course standard blades were preferred to keep cost down.

Where to find such a cutter?

After studying all makes, the engine builder found that there was just one type of cutter that could do all this and also had the necessary rigidity and strength.

That cutter had already proved itself in a year and a half of service *in Cleveland, Detroit and Lima.*

It was the **WESSON** Standard High Speed Fine Finish Cutter—one of **WESSON'S** famous RIGIDCUT Series.

Reason: With the **WESSON** design you can use standard carbide tipped dovetail blades. *No space is needed in the gullet for the lock.* The blades lock from the bottom. You get smooth chip flow, with no obstructions, remarkable rigidity, solid blade backing.

Its no wonder that **WESSON** Rigidcut mills are setting new production records for output and tool life in all kinds of operations, everywhere.

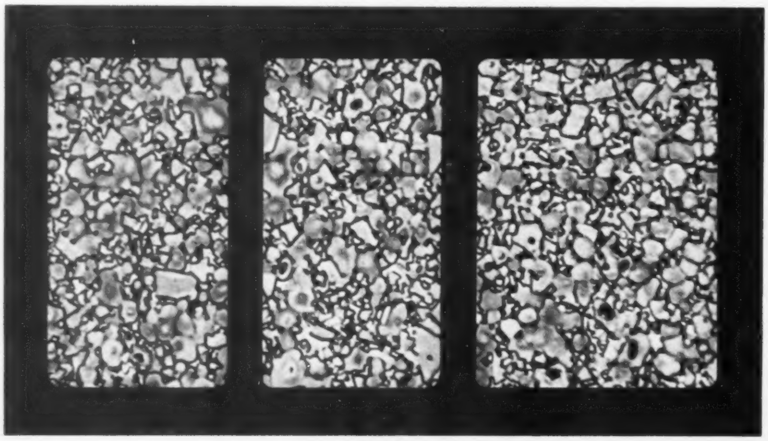
If you are not familiar with Rigidcut milling cutters, our merchandising department will send you complete information. Just write on your company letterhead. You'll be glad you did.

TOOL carbide NEWS

tools Wesson carbide Wessonmetal

WESSON COMPANY DEPT. AD
1220 Woodward Heights Blvd., Detroit 20, Mich.
IN CANADA:
WESSON CUTTING TOOLS, LTD.
93 JUDGE ROAD, TORONTO 18, ONTARIO

"Inside Story" of Grades Told in Selector Bulletin



1500X Photomicrographs of the same Wessonmetal grade. Note close similarity.

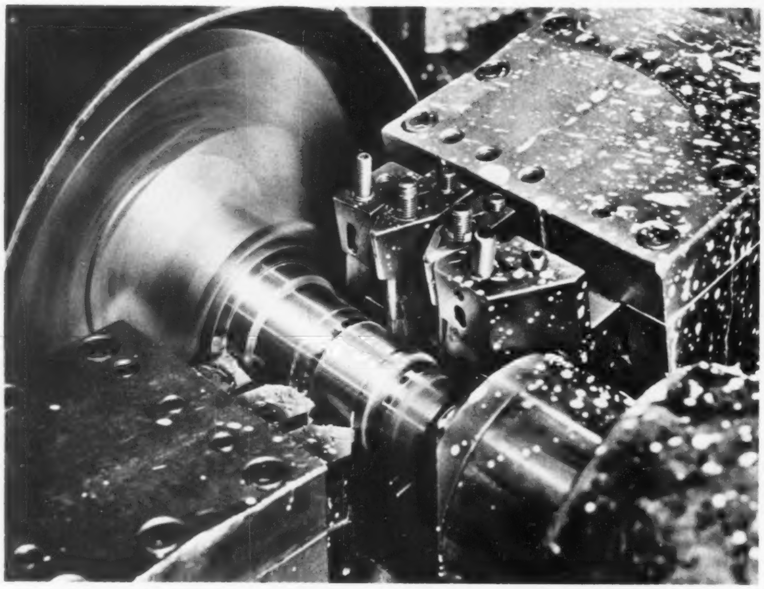
You can find a quick answer to what grade of carbide to use (and why) in a new technical bulletin just released by **WESSON**.

The bulletin tells how various ingredients added to tungsten carbides affect performance and tool life. You can use it as a standard method for selecting and applying carbides on the basis of operational needs in your own plant.

It is the soundest method of carbide grade selection *when carbides are as consistent* in chemical analysis and physical characteristics as are the various Wessonmetal grades.

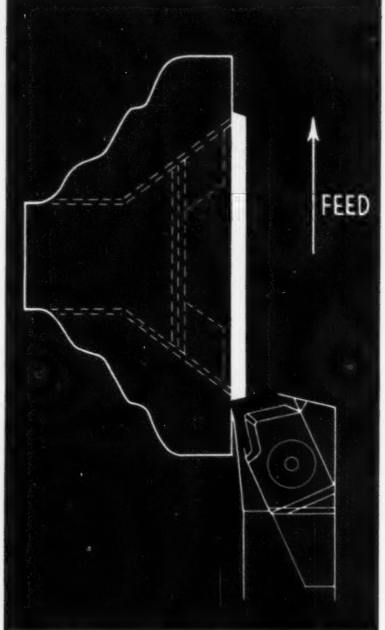
Ask for Bulletin No. 57-1 WM.

Multi-Cuts Cut Waste Time 90%



"A production of over 1400 parts per grind, compared with about 200 pieces per grind previously" is one report on **WESSON** Multi-cut band type tools with indexable inserts. They are indexed only once every shift. In addition, the report says, the grooving tools shown here helped to cut total machine service time by 90%. Tool pre-setting time is completely eliminated. Downtime for tool changes is cut in half. And grinding time is cut 80%.

Throw-Aways Throw Costs for Loss



Here are a few typical figures that tell their own story probably better than we can. The job is the facing of a shell-molded diffuser. The column at the left is for a conventional flat tool. The one at the right is for a **WESSON** THROW-AWAY:

	WAS	IS
Tool change time (secs.)	300	30
Pcs. per tool change (index)	130	280
No. of grinds or edges	10	8
Cost per grind	$0.25	None
Tool grind cost	2.50	—
Initial tool or insert cost	3.15	1.58
TOOL COST PER PIECE	.024	.0071

Want some specs on **WESSON** throw-away tooling? Ask for Bulletin No. 55 10 M.

LITHO IN U.S.A.

4 OF THE MANY STYLES OF THE ONE-PIECE SEAMLESS DOOR KNOBS FABRICATED FROM RUGGED REVERE BRASS STRIP.

REVERE BRASS STRIP

Stands the Gaff!

The one-piece door knobs shown are drawn from a single blank of Revere Brass Strip, presenting an attractively smooth, unbroken surface without the need for seams or welds.

Because they are made by a unique procedure the manufacturer tells us that the brass must stand up under mighty rugged going, and that to produce the quality knobs they do, at an economical production level, the brass they use must have:

1. *Uniformity of gauge.*
2. *Absence of any sign of fracture or crimping when drawn.*
3. *Consistently correct grain structure to insure a smooth, flaw-free surface on the finished knobs.*

The manufacturer also tells us that Revere Brass Strip has been filling that bill, with utmost satisfaction, for some time.

Revere Brass Strip may be able to help *you* make a better product at less cost. You'll never know until you talk it over with one of our TA's (Technical Advisor). There's no obligation, of course. And such a discussion could save you a substantial sum of money. Such has been the case many, many times.

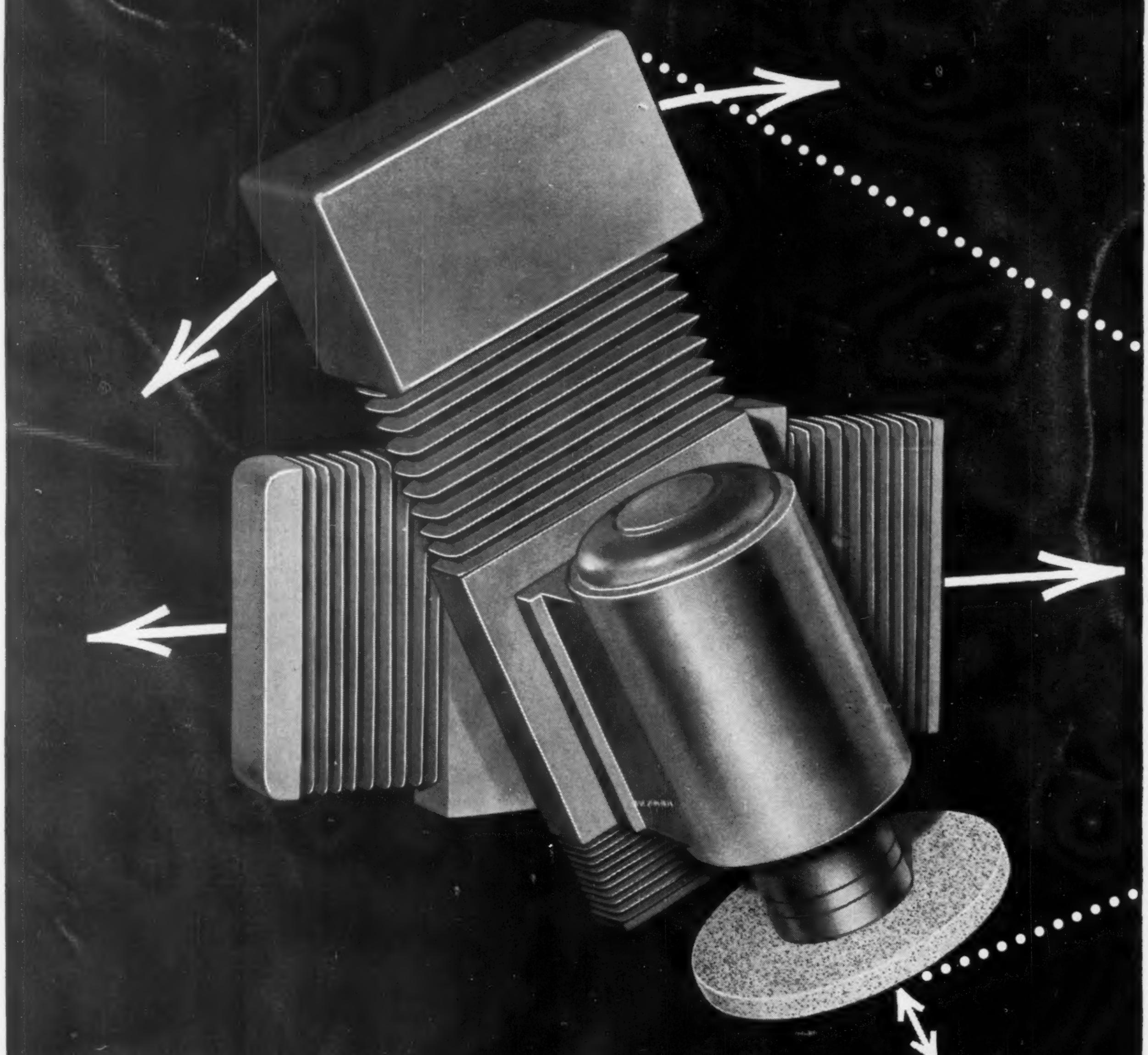
COPPER ★ BRASS
1801
★ REVERE ★
ALUMINUM

REVERE COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
230 Park Avenue, New York 17, N. Y.

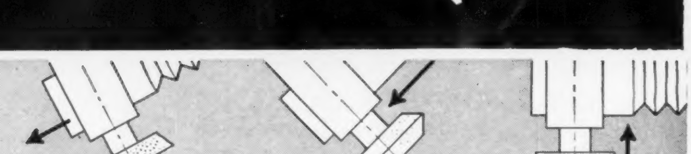
Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

For more information fill in page number on Inquiry Card, on page 223

PRECISION GRINDING



Diagrams show typical applications of Frauenthal Standard Slide Units to a variety of grinding problems.



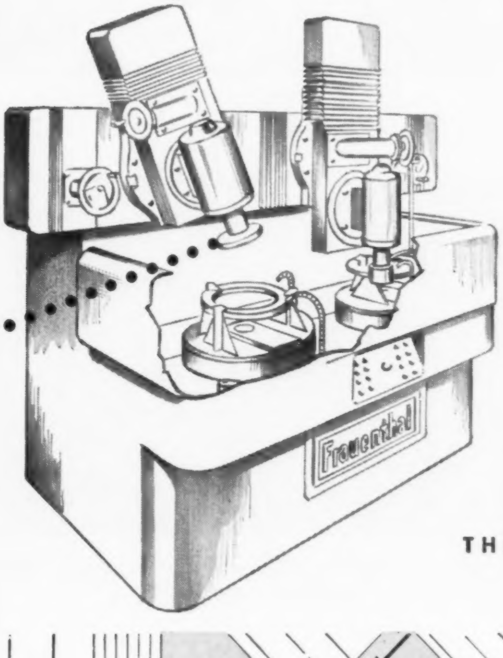
at any angle!

Frauenthal's creative engineering <u>Now</u> makes available Standard Slide Units in any number of combinations for production grinding applications . . .

IT IS NO LONGER NECESSARY to absorb special engineering and design costs when Frauenthal Standard Slide Units — plus a variety of grinding spindles — can be assembled to machine bases appropriate to a particular job. And these standard slides in single or multiple units can be arranged in an infinite number of spindle positions to accommodate an endless variety of simultaneous or sequenced, automatically controlled grinding operations.

What's more, you get all the advantages of Frauenthal's advanced engineering and design experience—proven on single and multiple-head grinders used on special production jobs. For example: parts for jet engines, diesel and automobile engines, tanks, gun mounts, radar units, large and small diameter precision bearings and machine tool components.

As illustrated here, this model of the versatile grinding compound shows how the Frauenthal Standard Slide Unit can be adapted to approach the work from any desired angle.



Here's a typical Frauenthal Double Head Vertical Spindle application utilizing two of the Frauenthal Standard Slide Units shown on the opposite page. Although applied to a particular grinding situation, these slide units retain versatility for angular positioning. Frequently, as indicated in panels 2 and 4 at the bottom of the page, diameters and adjacent surfaces are ground at one time with a single wheel dressed to the proper contour.

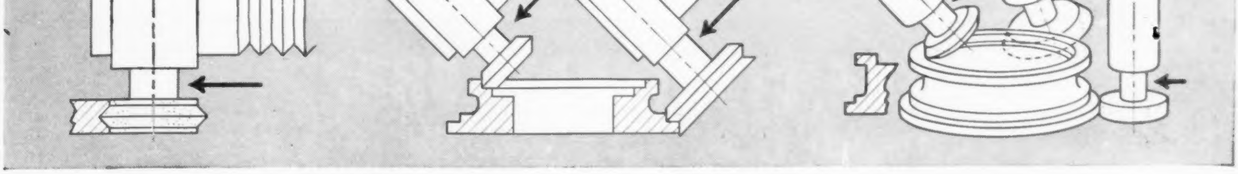
Send a print of your "problem grinding part" and our engineers will show you how to apply Frauenthal Standard Slide Units to solve the problem. Include in your letter pertinent production information — number of pieces, etc. Be sure to investigate the latest Frauenthal Vertical Grinders with Standard Slide Units. For complete details, contact Frauenthal of Muskegon.

Frauenthal Division

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN, U. S. A.

F-256



For more information fill in page number on Inquiry Card, on page 223

Cincinnati Press Brake Dies

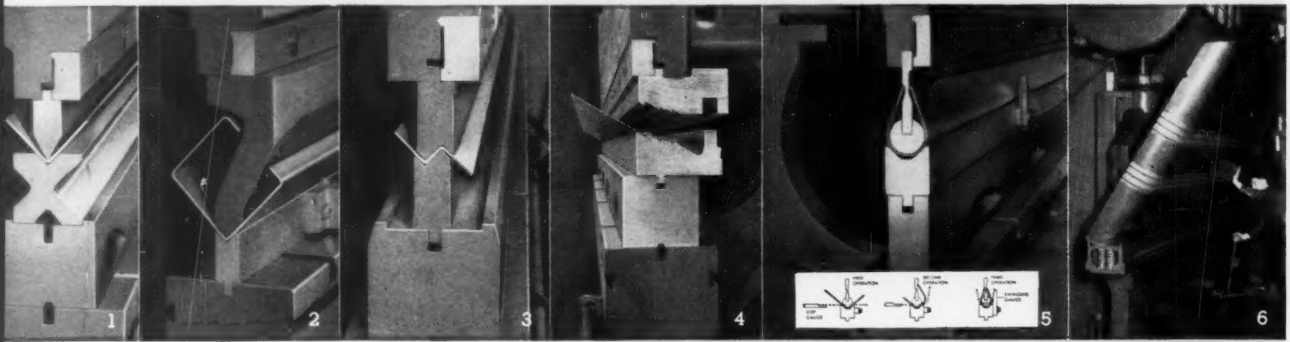
COMPLETE DIE SERVICE

The problem of selecting the proper die is constantly recurring, and many times calls for the best technical skill and accumulated experience available. The Cincinnati Shaper Company offers complete facilities for manufacturing hundreds of dies, for the forming of a variety of products. Also available are the prompt services of our Application Engineers, a department thoroughly experienced and equipped to engineer the special dies you may require.

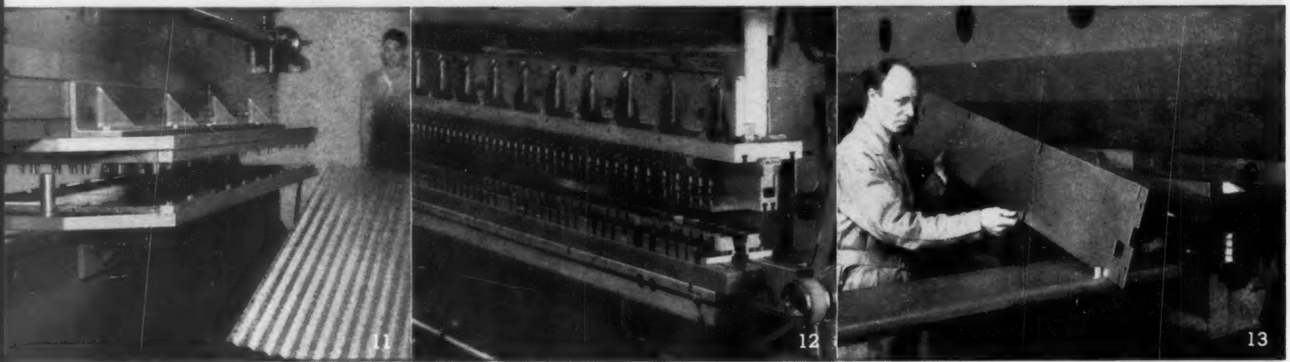
APPLICATION ENGINEERING DEPARTMENT

Our Application Engineers stand ready to give your production problems individual attention. They will aid you in the selection of proper punching equipment, if punching is your problem. A background of 30 years of widely varied experience is represented in this department, in literally every field associated with our machines.

To permit our Application Engineers to be of maximum service, as much information as possible should be given when sending us an inquiry or an order. Small details such as angles and radii on even the simple dies depends on such data. With complete information we will be able to make sound recommendations on methods



A typical 4-way die, equivalent to 4 single vee-dies, is shown in photo 1. Photos 2 and 3 show gooseneck and offset dies, respectively. A special die for producing 16 gauge molding is shown in photo 4. The closed U bend shown in photo 5 is formed in 3 hits. Photo 6 shows a large truck body panel being formed.



Tooling for punching grain bin sheets is mounted on special bolsters in photo 11 Spring plungers are used for strippers. Photo 12 shows a double row punching setup. Gags are used to give different hole groupings. Four edges of a control cabinet blank are punched and notched on the setup shown in photo 13.

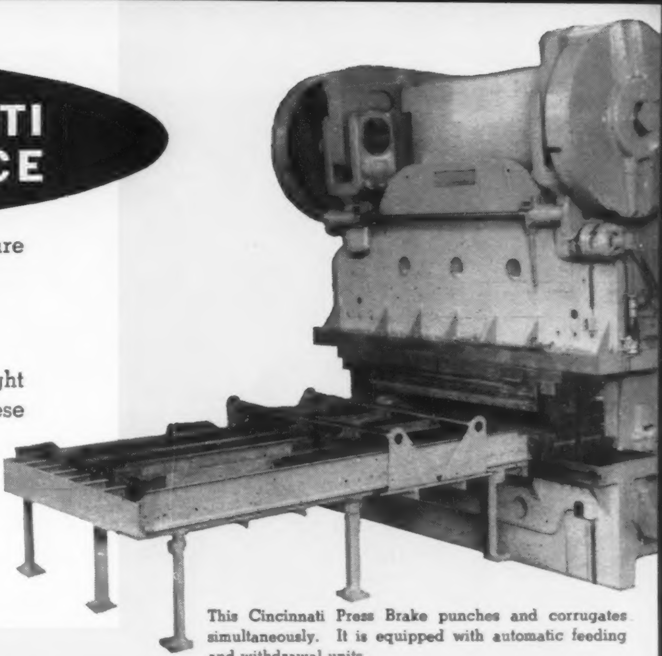
CINCINNATI

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS · SHEARS · PRESS BRAKES

A COMPLETE CINCINNATI ENGINEERING SERVICE

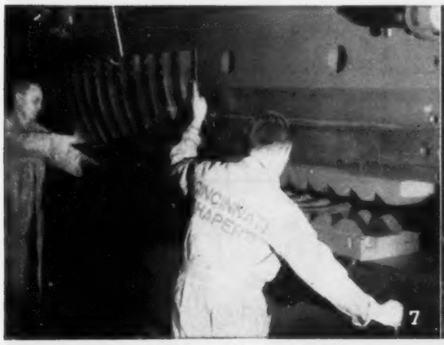
and die design, as well as an estimate of the pressure that will be required.



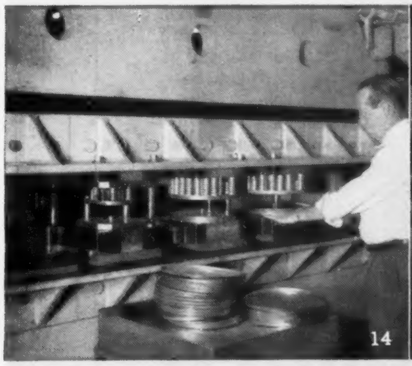
This Cincinnati Press Brake punches and corrugates simultaneously. It is equipped with automatic feeding and withdrawal units.

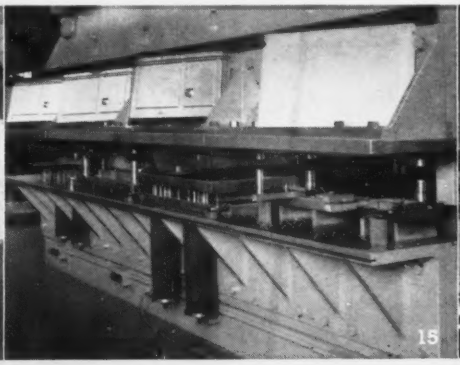
DIE MANUFACTURING

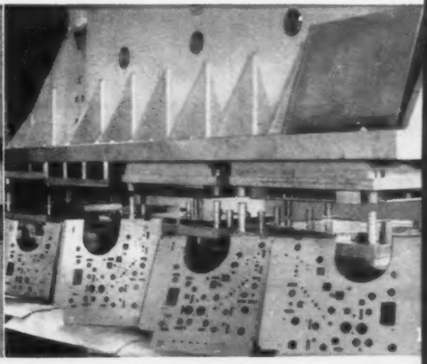
Dies cannot be classified as "standard" even for right angle bends, since there are many designs for these dies alone. Therefore, we do not stock finished dies. Instead, we carry a large stock of brake die steel. Our machining, assembling and testing facilities are ample for producing high quality, fully tested dies for any Press Brake work.



The dies shown in photo 7 form corrugated culvert sections in successive hits. Photo 8 shows conical sections being formed with standard dies. Steel roof decking is made with the "double-decker" dies shown in photo 9. The setup shown in photo 10 produces 2 miles of galvanized gutter per hour.

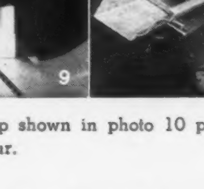


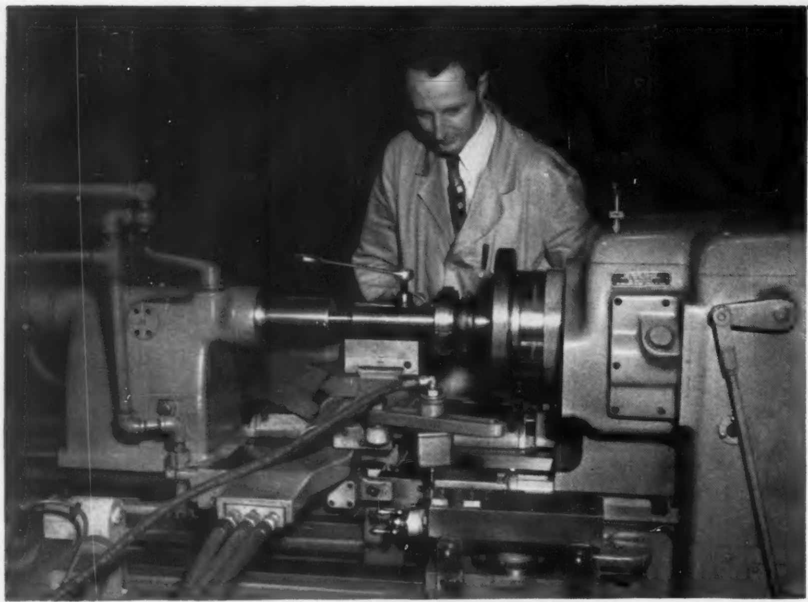




The progressive die setup shown in photo 14 is used for punching and drawing switchboard parts. Photo 15 shows a progressive die setup for making refrigerator top components. Pressure for draw operation is provided by rubber cylinders. Photo 16 shows a progressive die setup for producing television chassis.

The photos on these two pages show just a few samples of the Press Brake tooling and material-handling equipment designed and furnished by the Cincinnati Shaper Company. For more information, write Department D for Catalog D-2.



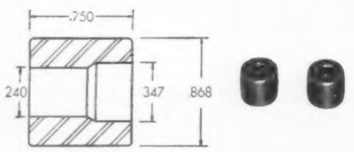


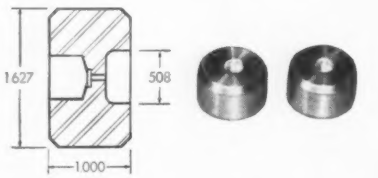
Finish turning operation on a hi-speed steel heading die, using a Monarch 13" Series 61 Air-Gage Tracer Lathe, .015" stock is removed within a limit of ±.0005". Turning time is 15 minutes compared to 2 hours previously required on a conventional engine lathe.

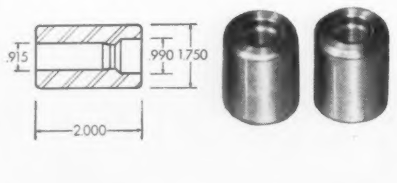
WITHOUT MONARCH–TIME'S A-WASTING!

Air-Gage Tracer Lathes Cut Contouring Time from 2 Hours to 15 Minutes — ± .0005"!

Group of typical heading dies which are finish bored on the 10" Model EE Air-Gage Tracer machines. Drawings show complexity of work. Under the same conditions as above, the same time savings are realized.







Can you ignore savings like these reported by Standard Pressed Steel Company?

They use a battery of Monarch Air-Gage Tracer lathes in their production toolroom for finishing operations on small forging dies. Most of the work is contour boring to exceptionally close limits plus quite a variety of contour turning.

The machines go sixteen hours per day, six days per week. Monarchs were chosen because of Standard Pressed Steel's previous satisfaction with this make of lathe. The Monarch flame hardened, precision ground bed ways are considered a must in this plant. These tracer controlled lathes are much faster and more accurate than the conventional engine lathes previously used and more uniform in performance.

Now, check over the job reports in the picture captions. Two hours cut to fifteen minutes! You're right—you can't ignore savings like these! Write now for our Booklet # 2608... **The Monarch Machine Tool Company, Sidney, Ohio.**

Monarch

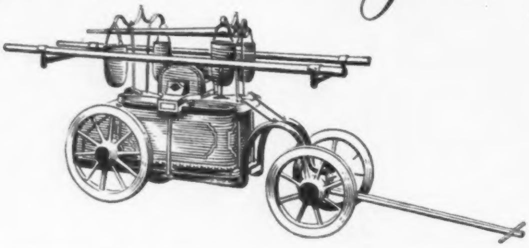
ACCURACY • ECONOMY • LONG LIFE

TURNING MACHINES

FOR A BETTER TURN FASTER . . . TURN TO MONARCH

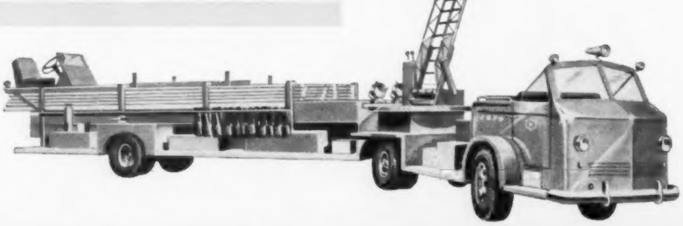
For more information fill in page number on Inquiry Card, on page 223

Great in its day . . .



BUT

WOULDN'T YOU RATHER HAVE THE LATEST TECHNICAL ADVANCE?



Now from **Heller** *A great new advance that lowers metal cutting costs*

HAND AND POWER "*Job Tempered*" Hack Saw Blades

Certified by American Standards Testing Bureau to meet their standards for superior cutting: Uniform Teeth, Uniform Set, Uniform Temper*

Clean, efficient, *lowest cost* cutting can only be obtained from *uniform*, consistent quality blades such as produced by Heller's unique, Job Tempering process.

In Heller Job Tempered hand and power blades, uniformity begins right with the raw steel which is made to specification and minutely inspected for analysis and proper grain structure. Teeth are *milled* to uniform size, shape and spacing by the most modern, highly specialized equipment in the industry. Uniformity of tooth set is precisely measured with an indicator specifically developed for this purpose.

Then Heller's unique heat treating technique, *carefully matched to the metallurgy of the steel*, brings about exceptional uniformity of temper the full length of the blade — and from one blade to the next.

That's why *every* Job Tempered hand or power hack saw is certified by American Standards Testing Bureau to meet their standards for superior cutting: uniform teeth . . . uniform set . . . uniform temper — your assurance of outstandingly better, *lower cost* service on the job.

SOLD EXCLUSIVELY THROUGH

Heller DISTRIBUTORS

"YOUR OUTSIDE TOOL ROOM"

Heller "Job Tempered" Tools

* AMERICAN STANDARDS TESTING BUREAU INC. ASTB

HELLER TOOL CO. TRADE MARK SINCE 1836

Heller

HELLER TOOL CO., *America's Oldest File Manufacturer*
Newcomerstown, Ohio — A Subsidiary of Simonds Saw and Steel Co.

For more information fill in page number on Inquiry Card, on page 223

Scott Wipers* are used to clean the feeder screw of this 42' vertical boring mill, one of the largest in the East. Other wiping jobs: all kinds of metal cutting machines, tools, instruments, stock, hands, face, glasses.

*PATENT PENDING

WIPER PROBLEM? Look what Baldwin-Lima-Hamilton did with Scott Wipers!

The Southwark shop of BLH's Eddystone Division, Philadelphia, makes giant machinery, hydro-electric turbines, parts for Diesel engines, dump cars. Cloth wipers had to be dispensed from a central tool crib—caused lost time, and laundry, storage and handling expense. They turned to Scott Wipers . . . to help reduce these problems.

Scott Wipers are easily stored in each work area. Fresh from the box, they hold no foreign particles to cut or scratch. They're easily disposed of, after use. Their use has resulted in substantial savings in *production hours*, as well as in material costs. And workers who use them, like them!

Soft, absorbent Scott Wipers are 2-ply, for extra strength. Chemically treated for proper wet strength. Lint-free, odorless, and Perf-embossed,® a special process that gives thorough cleaning action, faster liquid absorption. For more details, call your local Scott distributor, or write Scott Paper Company, Department M-78, Chester, Pennsylvania.

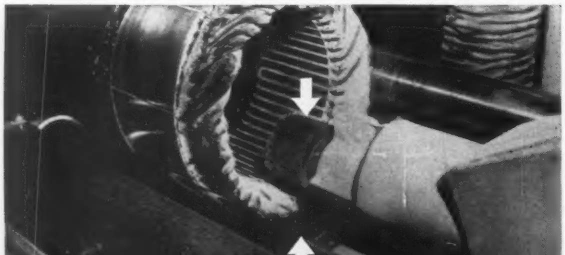
SCOTT PAPER COMPANY

Makers of the famous Scott paper products you use in your home. Consult TV schedules for Scott's program, "Father Knows Best."

OSBORN BRUSHING METHODS *worthy of your confidence*

Fast cleanup...

inside and out with Osborn Power Brushing



Dual cleaning job *at a fraction of the cost using Osborn Power Brushes.*

THE problem—to clean varnish from both the inside and outside surfaces of electric motor stators. Formerly, two cleaning operations were necessary. Results were inconsistent . . . the operations costly and time consuming.

With Osborn Power Brushes, the entire cleaning job is now done at the push of a button—and for a fraction of the previous cost. The operator merely places the stator on guide rolls. Brushes are automatically moved across the external and internal surfaces of the lamination stack. The varnish is quickly and thoroughly removed.

An **O**sborn **B**rushing **A**nalyst is ready to survey your plant for similar results. There is no obligation. Write *The Osborn Manufacturing Company, Dept. D-37, Cleveland 14, Ohio.*

Write TODAY for the new 100-page Osborn Catalog 210-C.

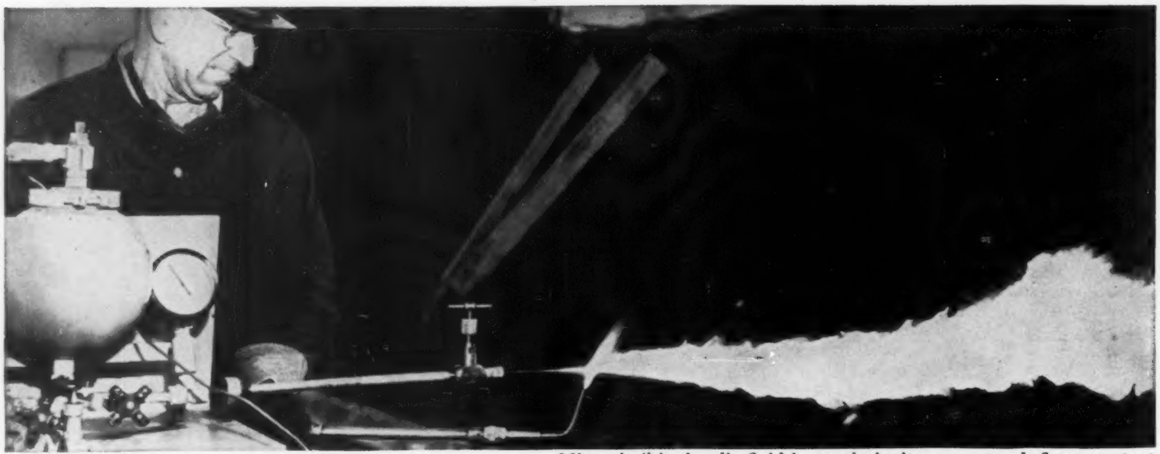
Osborn Brushes

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES • BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

For more information fill in page number on Inquiry Card, on page 223


Machine Tools And Power Transmission Equipment
STYLE GU — A packaged sealing unit containing both rotating and stationary seal faces enclosed in metal housing. Stock sizes for shafts .250 through 4.000.
Pumps And Compressors
ROTO-FLEX — Rugged flexibility. Only 3 parts. Single or double units. Stock sizes for shafts .250 through 4.000.
STYLE RFO — A specially designed Roto-flex seal, for installation outside the stuffing box. Stock sizes for shafts .250 through 4.000.
A Complete Line
GITS SHAFT SEALS
For Every Application
These modern, mechanical, face-type seals are carried in stock — to save you time and money. Write for detailed data.
GITS BROS. MFG. CO.
1858 South Kilbourn Avenue • Chicago 23, Illinois
Specialists In Lubricating Devices And Shaft Seals For Almost Half-A-Century
Heavy Machine Tools
STYLE DPC — A high-speed, carbon-faced seal, for more compact installation in heavy industrial machinery. Stock sizes for shafts .250 through 4.000.
Household Appliances
STYLE SGU—A factory-assembled unit-type seal for the small-budget user. Stock sizes for shafts .250 through 1.000.
Aircraft Engines And Accessories
STYLE HH — Absolute minimal space (both radial and axial) under extreme conditions of temperature, pressure and seal face surface speed. Features pressure balance when fluid pressure is applied internally or externally. Stock sizes for shafts .250 through 4.000.

For more information fill in page number on Inquiry Card, on page 223



Mineral oil hydraulic fluid instantly ignites upon torch flame contact

Fire resistance plus low cost

FOR MANY YEARS frequent industrial fires involving hydraulic fluids have taken their toll in man-hours and high costs. This has created a widespread need for a relatively inexpensive all-purpose, fire-resistant hydraulic fluid.

In undertaking this challenge, Shell Research Laboratories spent over four years in laboratory and field testing before a solution was reached. The result was the introduction of Irus* Fluid 902 . . . the first low-cost, oil-base fluid that, under plant conditions, actually snuffs out fire.

The new formulation is a specific combination of petroleum oils mixed with water and emulsifying agents. It gains its fire resistance through a relatively high water content. Irus Fluid is perfectly adapted to the majority of hydraulic systems. The following is typical of many reports in Shell files.

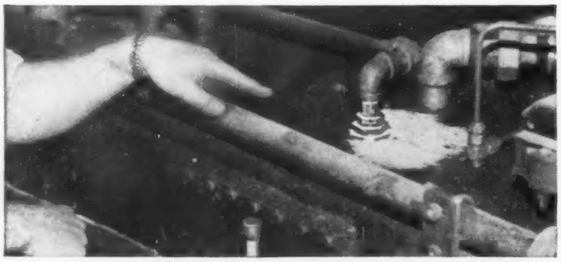
Typical Problem and Solution

The welding plant of a prominent automotive manufacturer employing 100 hydraulically operated electric welders formerly used a straight mineral oil fluid. On one occasion, damaged fluid lines allowed this mineral oil under high pressure to spray directly onto the welding area. Sparks ignited the fluid . . . caused an immediate flash fire which resulted in 75% machinery damage before it was extinguished. Immediately following this incident, the changeover was made to Shell Irus Fluid 902. Shortly thereafter a line broke and the high-pressure spray once more contacted welding sparks. There was no fire at all . . . and in a matter of minutes the machinery was operating at full efficiency.

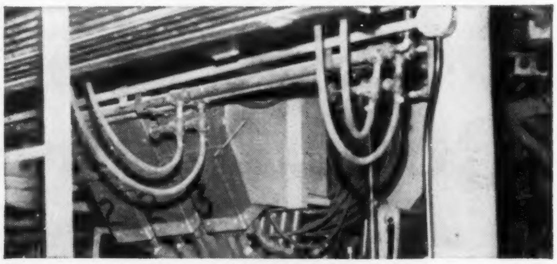
The two photos above provide dramatic proof of its flame resistance. In the photo on the left, conventional hydraulic fluid instantly ignites upon contact with an oxy-acetylene torch flame, whereas Shell Irus Fluid 902 (right photo), under the same conditions, does not support combustion beyond an inch or two from the flame. *Under plant conditions, it actually snuffs out fire!*

Two-Way Economy

An advantage not to be overlooked is the low cost of Irus Fluid 902. Many plant operators now making the



A leak is quickly spotted because of Irus Fluid's distinctive yellow color.



The complexity of cable lines necessitates the use of a fire-resistant hydraulic fluid to eliminate fire hazard.

Under the same conditions, Shell Irus Fluid 902 clearly demonstrates its fire resistance

in a new hydraulic fluid

switch to Irus Fluid find that it costs up to one-third less than other fire-resistant fluids—and its performance is comparable in every practical respect. This money-saving advantage is a vital consideration not only in the initial purchase price, but in reducing make-up loss expense.

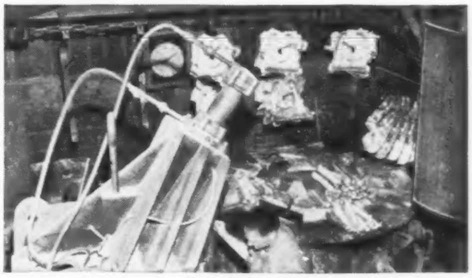
Irus Fluid 902 has other features, too:

1. **It contains no corrosive ingredients and has shown no harmful effects on normal seals, fittings, or bearings . . . it will not promote rust.**
2. **No major equipment modification is necessary . . . simply clean your present fluid thoroughly from the system and replace with Irus Fluid.**
3. **Practical application proves it has exceptional viscosity and lubricating qualities . . . doesn't thin out in use.**
4. **The yellow color of Irus Fluid enables you to spot and trace leaks easily . . . a valuable benefit in preventive maintenance.**

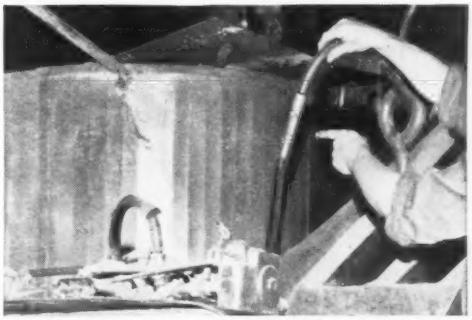
If your operation utilizes die-casting machines, plastic molding machines, glass blowing machines, permanent mold machines or any other hydraulic equipment where fire hazards are of concern, we suggest you investigate the advantages of Shell Irus Fluid 902.

Write or call the Shell Oil Company office nearest you.

*Trademark



Such specialized die-casting machines require a fire-resistant hydraulic fluid to assure maximum safety.



Finger points to line break in hydraulic cable that caused flash fire and machinery damage while operating with mineral oil type fluid.

SHELL OIL COMPANY

50 WEST 50TH STREET, NEW YORK 20, NEW YORK
100 BUSH STREET, SAN FRANCISCO 6, CALIFORNIA

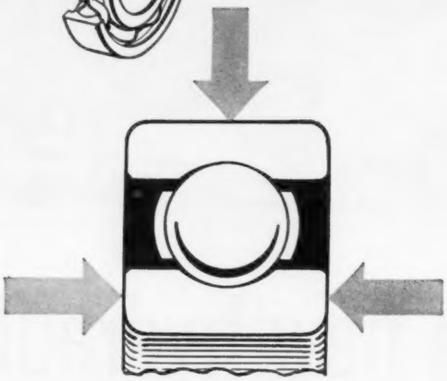
SHELL

For more information fill in page number on Inquiry Card, on page 223

FACTS

about

NEW DEPARTURE  **BALL BEARINGS**



The Word *Versatile* Fits Like A Glove!

Fits because—this basic New Departure ball bearing, more widely used than any other antifriction type, does much more than carry RADIAL loads—it locates the shaft it supports against THRUST LOADS FROM BOTH DIRECTIONS equally well!

Fits because—with a simple snap ring added, it does away with inside housing shoulders, simplifying mounting and cutting machining costs!

Also—with efficient Sentri-Seal added, without change in exterior dimensions, it eliminates a separate outside closure —assures protection from outside dirt!

And—with Sentri-Seals on both sides, this same basic bearing does away with all separate seals, eliminates all need for lubricating fittings—requires no attention for greasing!

Finally—it is a long-lived, non-separable unit that calls for no shims or other devices for periodical adjustments.

So, specify New Departures of the type that assures you maximum application proficiency and economy.

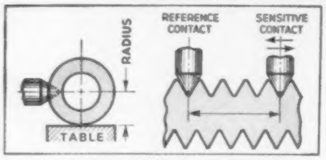
BALL BEARINGS MAKE GOOD PRODUCTS BETTER

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONN.

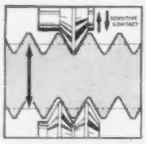
For more information fill in page number on Inquiry Card, on page 223

It's So Easy and Costs So

THREAD GAGES



Lead accuracy is precisely determined at a glance. Error is not averaged as with multiple contact anvils.

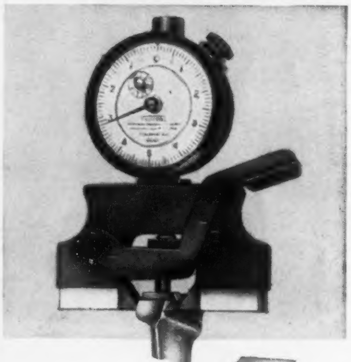


Lead errors do not affect readings. Contacts engage one thread only.

Thread Lead Gage Model 1141
Compares lead of screw threads —also spacing of holes, notches, grooves, etc.

Pitch Diameter Gage Series 45
For fast inspection of pitch diameter of threads by roller contacts.

DEPTH GAGES



Modifications of stock model depth gages facilitate production line inspection.

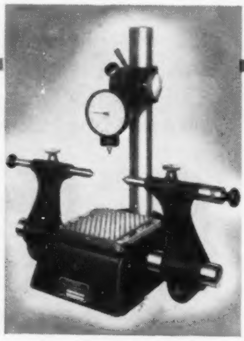
Bench Type Indicating Depth Gage
Model 75B-1 Long, 2″ range.

COMPARATORS

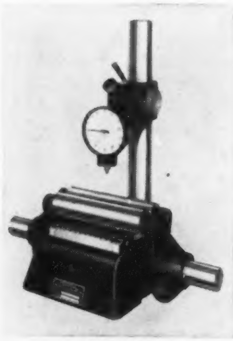
OVER TEN TYPES

Universal Dial Comparator Model 100B-20

Highly accurate instrument. Attachments shown greatly extend gage's versatility.



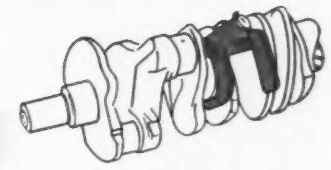
Center Attachment
Model A-100B-20-3



Roller V Block Attachment
Model A-100B-20-4

The "Super Benchmaster" Model 110B-3
Accurate to 50 millionths.
Capacity 0″—3.750″. The ultimate in mechanical gage precision.

Little to SEE How You're Doing



You really know quickly and definitely how closely you are working to the required dimensional specifications when you use these and any of the many other Federal Dial Indicating Gages.

You see ahead of time whether you are taking off too much metal before you produce any scrap. You can see on the Dial Indicator just when you have obtained the correct dimension.

And you'll find these low cost gages will take care of the greater number of your requirements. There's no need of spending more money for more elaborate, higher priced gages except where their use is really necessary. Federal offers a big selection of gages from which you can select the best for your purpose. Do you have our catalog? If not, write.

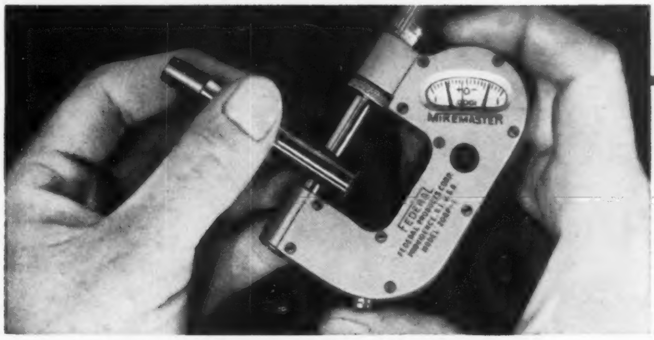
FEDERAL PRODUCTS CORPORATION
7118 Eddy Street • Providence 1, R. I.

Indicating Crankshaft Gage Model 1340P-40

Extremely thin, measures diameter of crankshafts where projections are large and/or closely spaced.

SNAP GAGES

INDICATING MICROMETER



Federal Mikemaster Model 200P-1
You read it more accurately. Always measures with same gaging pressure—provides uniform, accurate dial readings. Can be used as a micrometer, or an indicating snap gage.

GEAR GAGES

Pitch Diameter Gear Gages Series 202

Measure pitch diameter of spur gears, helical gears, splines, and chain sprockets — with either even or odd numbered teeth. Easy to use and reliably accurate.

CATALOG 55G

Shows most complete line of dial indicator gages. Send for your copy.

Ask **FEDERAL** *First*

FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic – for Inspecting, Measuring, Sorting, or Automation Gaging

For more information fill in page number on Inquiry Card, on page 223

The ordinary fasteners securing the worm wheel to the drum shaft in this automatic screw machine loosened, causing $120 worth of damage to parts. Labor for the repair job cost $100. The ordinary fasteners were replaced with self-locking UNBRAKOS, and there has been no trouble since.

Vibration won't loosen self-locking UNBRAKO socket cap screws

HOW IT LOCKS. The tough, resilient Nylok locking pellet keys itself into the mating threads. It forces threads together and locks the screw securely—whether or not the screw is seated.

UNBRAKO socket screws with the Nylok* self-locking device eliminate fastener problems caused by vibration.

Take the drive system in the automatic screw machine illustrated above, for example. The screws originally used to secure the worm wheel to the drum shaft loosened, causing considerable damage, besides loss of production time. These have now been replaced with self-locking UNBRAKO socket head cap screws and the trouble has been eliminated.

An UNBRAKO socket screw with the Nylok self-locking device is a single unit. Just screw it into any tapped hole. Seated or not, it locks positively wherever wrenching stops. Constant vibration or endless running of a machine won't affect these self-locking UNBRAKOS. The screws will not work loose!

Write today for your copy of Form 2193, which gives catalog and technical data on the complete line of UNBRAKO socket screws with the Nylok self-locking device. Or see your local industrial distributor. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 19, Pa.

UNBRAKO SOCKET SCREW DIVISION

STANDARD PRESSED STEEL CO.

SPS

JENKINTOWN PENNSYLVANIA

*T.M. Reg. U.S. Pat. Off., The Nylok Corporation

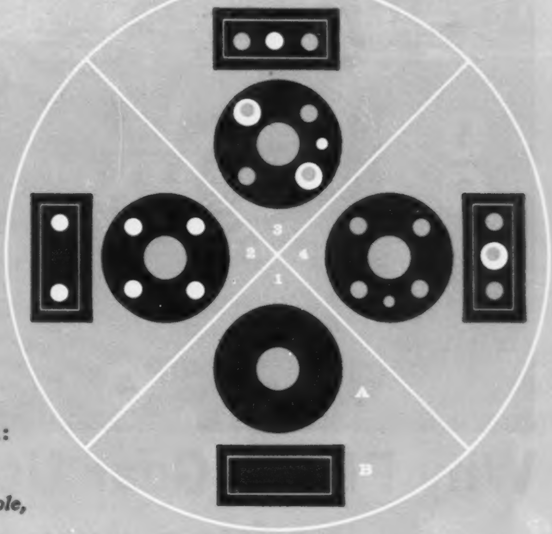
For more information fill in page number on Inquiry Card, on page 223

Natco Naturals

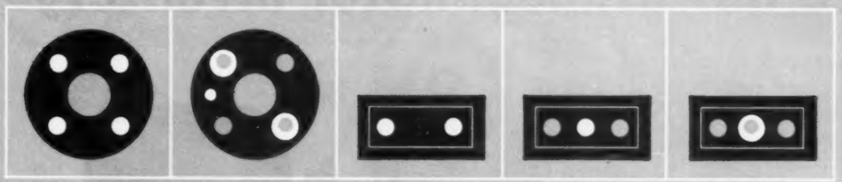
Cost-Cutting Ways
You Can Use
Standard Multi-Spindle Natcos

Any time your parts require machining *more than one hole*–drill, bore, face or tap–it may well be a "Natco Natural." Your standard Natco will produce substantial savings in a surprising number of situations, *even in small job-shop lots!* Call in your nearby Natco field engineer; he'll tell you in short order whether you've got a "Natco Natural" there.

Multiple Drilling Operations on Two Part-faces

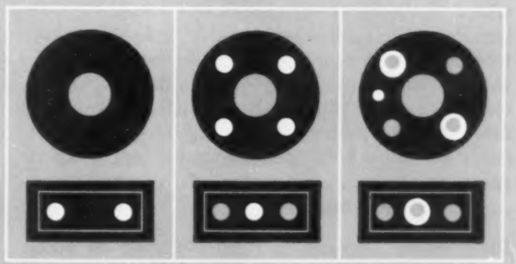


130 parts per hour–4-position rotary table. POSITION **#1:** *Unload finished part, transfer half-finished part, load new part.* POSITION **#2:** *Drill 4 holes, Face A. Drill and countersink 2 holes, Face B.* POSITION **#3:** *Drill 1 hole, ream 2 holes, Face A. Drill 1 hole, Face B.* POSITION **#4:** *Trepan 1 hole, Face B.*

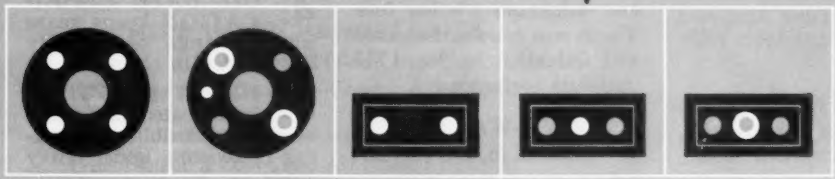


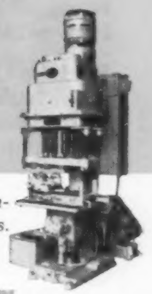
65 parts per hour–stationary fixture *with 5 work locations. Operator transfers parts after each stroke. One part completed per stroke.*

40 parts per hour–straight-line indexing. *After every 3 strokes, operator unloads finished part, transfers half-finished part and loads fresh part.*



23 parts per hour–tumble-type fixture. *Operator transfers and tumbles fixture from one position to the next. One part completed every five strokes.*





Standard multi-spindle Natcos range from 1 hp, 10-spindle machines to 50 hp machines with up to 72 spindles. Spindles in standard Natcos are driven through universal joints and located by either adjustable arms of bored slip plates.

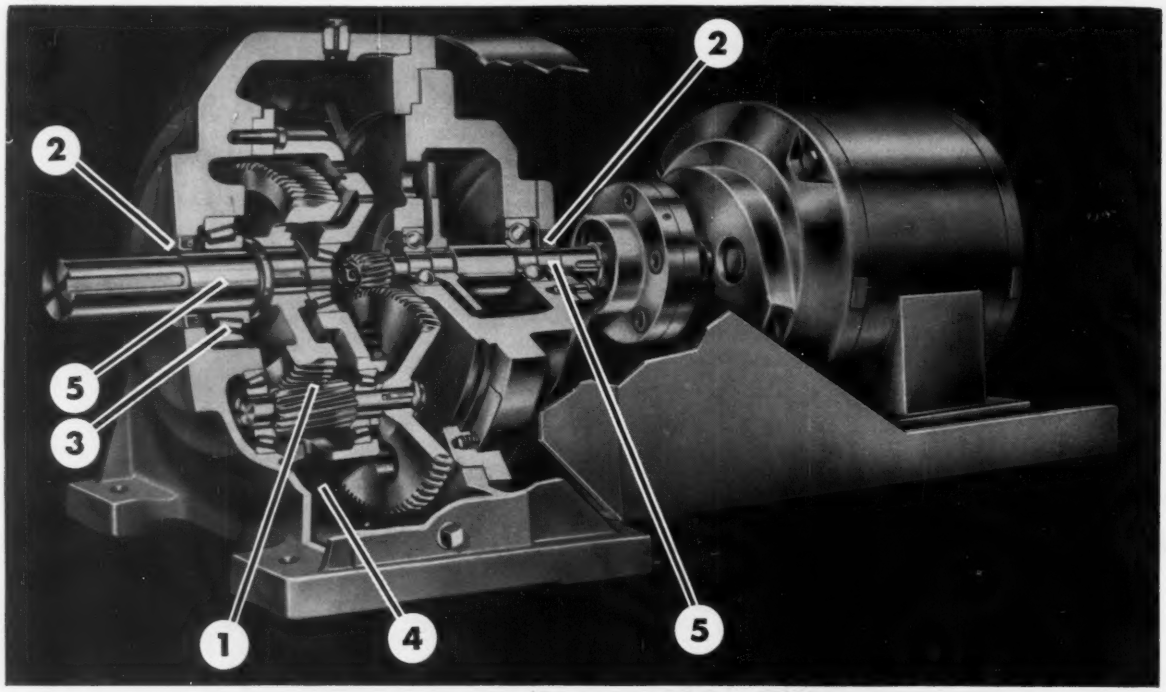
NATCO

National Automatic Tool Company, Inc.

Richmond, Indiana

Multi-spindle drilling, boring, facing & tapping machines. Special machines for automatic production.

Call Natco Offices in Chicago, Detroit, New York, Buffalo, Boston, Philadelphia, Cleveland, Los Angeles; distributors in other cities.

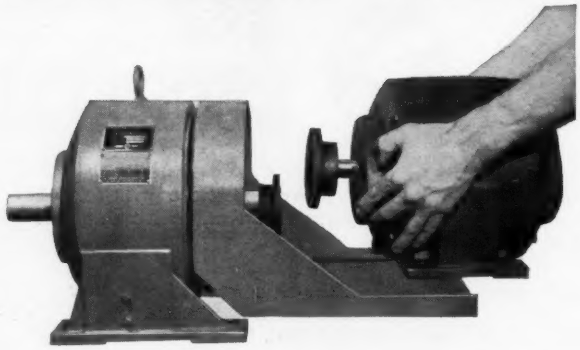


Why Phillie Gear Utility GearMotoRs reduce downtime...motor inventory

The new Philadelphia Utility GearMotoR has already won wide acceptance among plant engineers and designers, because: any standard NEMA foot-mounted motor can be used . . . *without special modifications for shaft, flange or supporting devices.* Here is a packaged power drive, ideal for use where flange-mounted motors are a supply problem. You can utilize readily available or existing foot-mounted motors immediately, because of the integral motor mounting base. This new Utility GearMotoR substantially reduces machinery downtime for motor changeover or replacement. Simply remove bolts securing motor feet, separate shaft coupling . . . lift motor off . . . and replace . . . all in a few minutes.

Steel motor support is rigidly ribbed to maintain shaft alignment, precision-drilled to receive NEMA motor frame mountings. Save time and money all around. Specify the Philadelphia Utility GearMotoR.

Send for Catalog GM-560 which fully describes and illustrates the new Philadelphia GearMotoRs, Utility GearMotoRs, In-Line Reducers and Motorized Worm Gear Drives.



1. HELICAL GEARING assures silent operation, increased strength, longer life and minimum friction loss. Teeth are crowned shaved and induction hardened for optimum performance.

2. TWO-WAY SEALS lock oil in, and seal dirt out.

3. OVERSIZE THRUST BEARINGS handle big overhung loads.

4. OIL BATH LUBRICATION keeps gears and bearings continually showered with clean oil.

5. HEAVY SHAFTING, heat treated alloy steel, eliminates possibility of bending or twisting under heavy loads.

phillie gear®

PHILADELPHIA GEAR WORKS, INC.

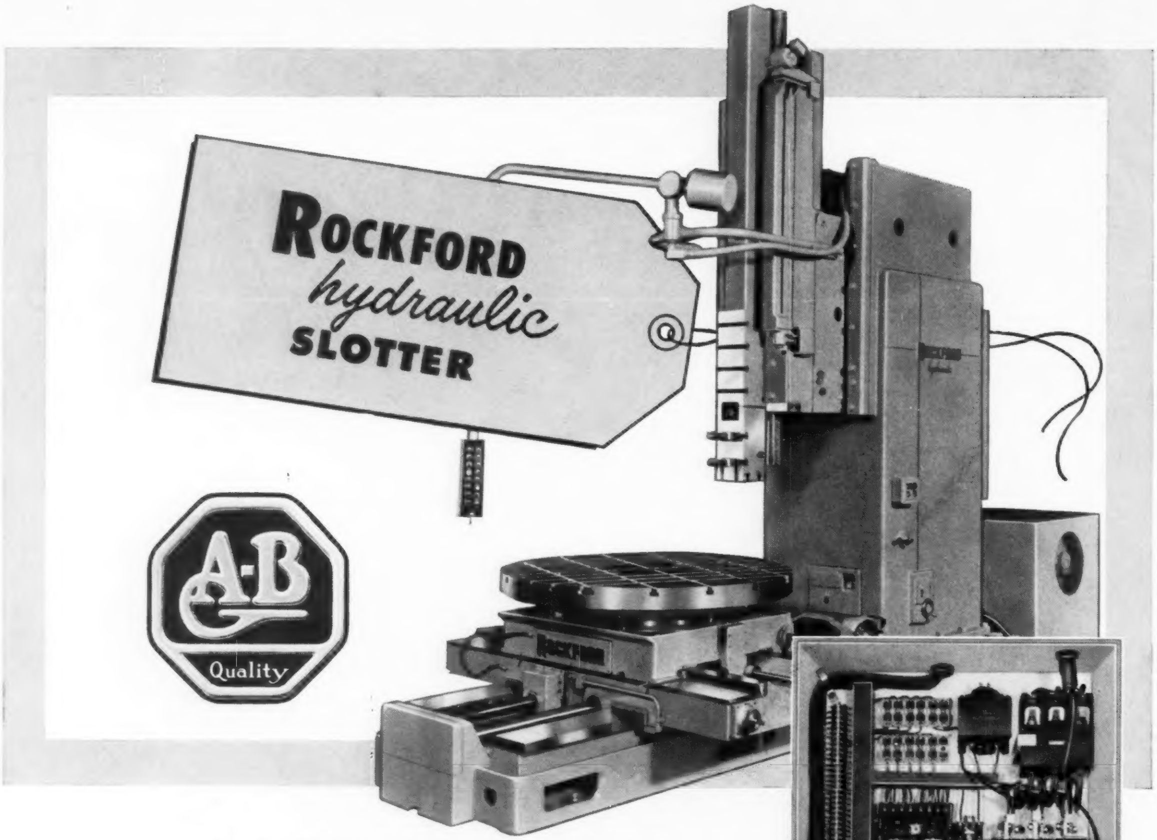
ERIE AVE. & G STREET, PHILADELPHIA 34, PENNA.

Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID MIXERS • FLEXIBLE COUPLINGS

Virginia Gear & Machine Corp. • Lynchburg, Va.

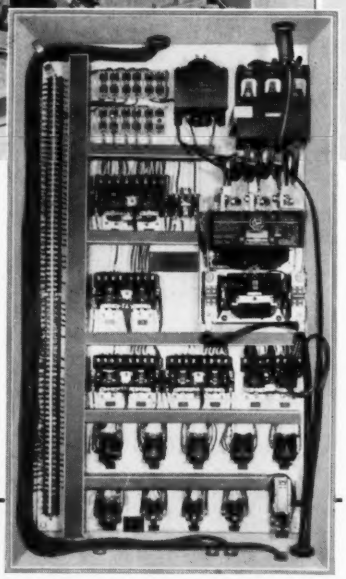
For more information fill in page number on Inquiry Card, on page 223



FACTORY EQUIPPED

with ALLEN-BRADLEY

Motor Control

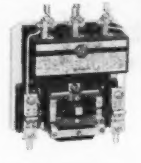


Special control panel uses standard Allen-Bradley units listed in A-B Handy Catalog.

Without its "electrical brain"—the motor controls—your modern machine would hardly be a production tool. The special control panel starts, stops, and reverses its motors in proper sequence, at just the right instant. And the higher the speeds, the more necessary it is that each motor be controlled with split-second accuracy.

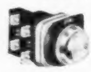
For modern, high speed production machines, Allen-Bradley is the *preferred* motor control. The reason for this leadership lies in the reliability and uniform operating speeds of all Allen-Bradley control units. Allen-Bradley solenoid relays, contactors, and starters have only one moving part. There are no bearings to corrode and stick. This simple design assures millions of trouble free operations. And the double break, silver alloy contacts . . . used on all Allen-Bradley controls...never need service attention.

To make sure that your machine tools are free from control failures, specify Allen-Bradley—you will never regret *this* decision!



Bulletin 709, Size 4 Across-the-Line Starter. These starters are made in 8 sizes up to 300 hp, 220 v; 600 hp, 440-550 v.

Bulletin 800T Oiltight Control Units



Raised "STOP" Button

Push to Test Pilot Light

Three Position Selector Switch

ALLEN-BRADLEY

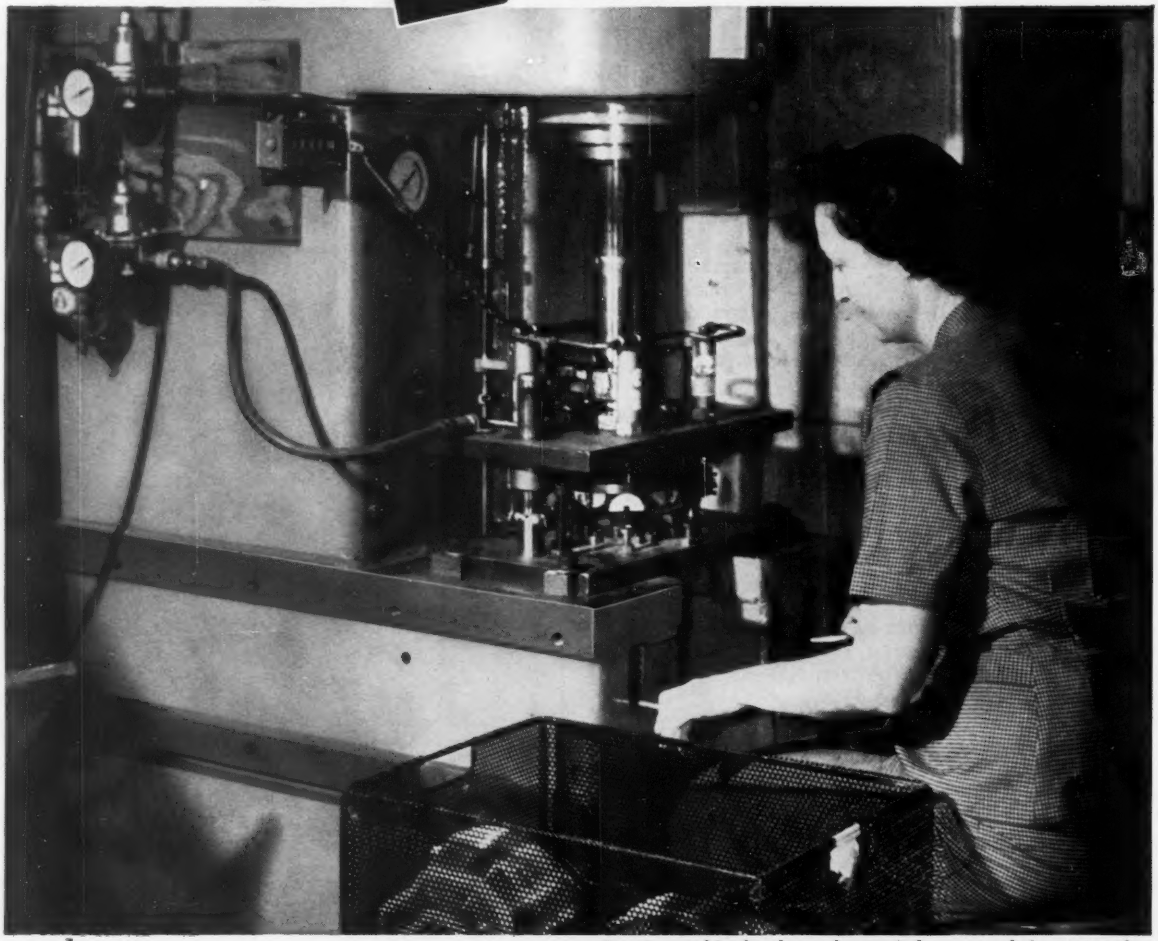
MOTOR CONTROL

QUALITY

Allen-Bradley Co., 1331 S. First St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

For more information fill in page number on Inquiry Card, on page 223

A Multipress case study



Forming multi-colored tops for music box carousels is an operation performed 1000 times per hour on this 8-ton hydraulic Multipress.

MULTIPRESS forms 1000 parts hourly for toy maker

DENISON'S hydraulic Multipress has greatly increased production . . . cut rejects . . . lowered costs for a Los Angeles toy manufacturer, Mattel, Inc.

In one operation, an 8-ton Multipress is used to form the top for a music box carousel. The lithographed and pierced metal blank is placed on an 8-piece die set which has two sets of conical shaped form blocks. Only one ram stroke is required to form the multi-colored tops at the rate of 1000 per hour.

Datalog MUL-2 describes in detail Mattel's use of Multipress. For your copy, write Denison Engineering Division, American Brake Shoe Co., 1244 Dublin Road, Columbus 16, Ohio.

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

OUT IN FRONT

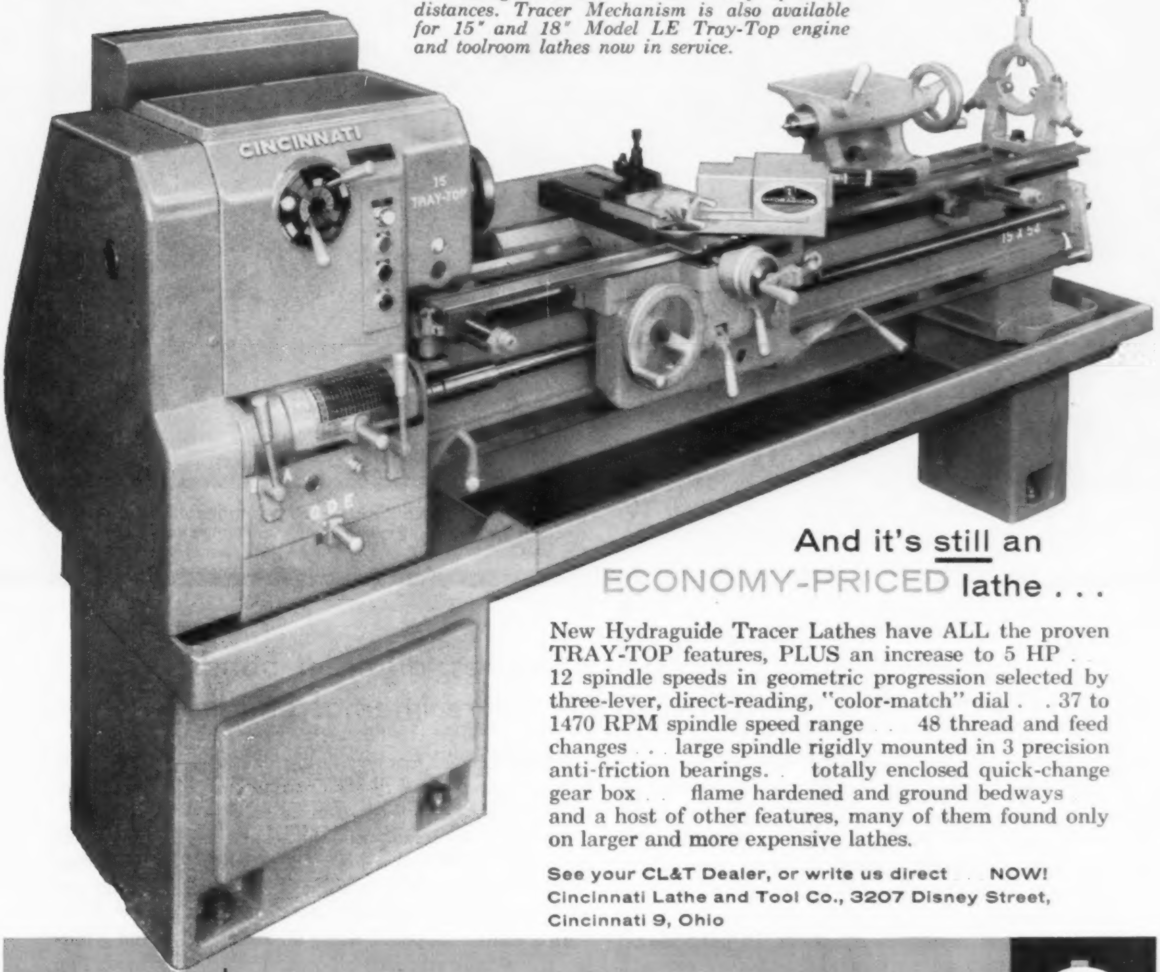
location of all controls, template and tools on the new

CINCINNATI HYDRAGUIDE

TRACER LATHES

provides maximum convenience and safety for the operator, yet does not interfere with standard lathe operations. Just push a single button and you switch to full tracer machining, or back to standard. Compact design has all tracer mechanisms on the carriage . . . no added floor space is required. And the increase to 5 HP gives you greater productivity at every turn!

Hydraguide Tracer Lathes are built in 15" and 18" swing sizes and a wide variety of center distances. Tracer Mechanism is also available for 15" and 18" Model LE Tray-Top engine and toolroom lathes now in service.



And it's <u>still</u> an

ECONOMY-PRICED lathe . . .

New Hydraguide Tracer Lathes have ALL the proven TRAY-TOP features, PLUS an increase to 5 HP . . 12 spindle speeds in geometric progression selected by three-lever, direct-reading, "color-match" dial . . 37 to 1470 RPM spindle speed range . . 48 thread and feed changes . . . large spindle rigidly mounted in 3 precision anti-friction bearings. . totally enclosed quick-change gear box . . flame hardened and ground bedways . . and a host of other features, many of them found only on larger and more expensive lathes.

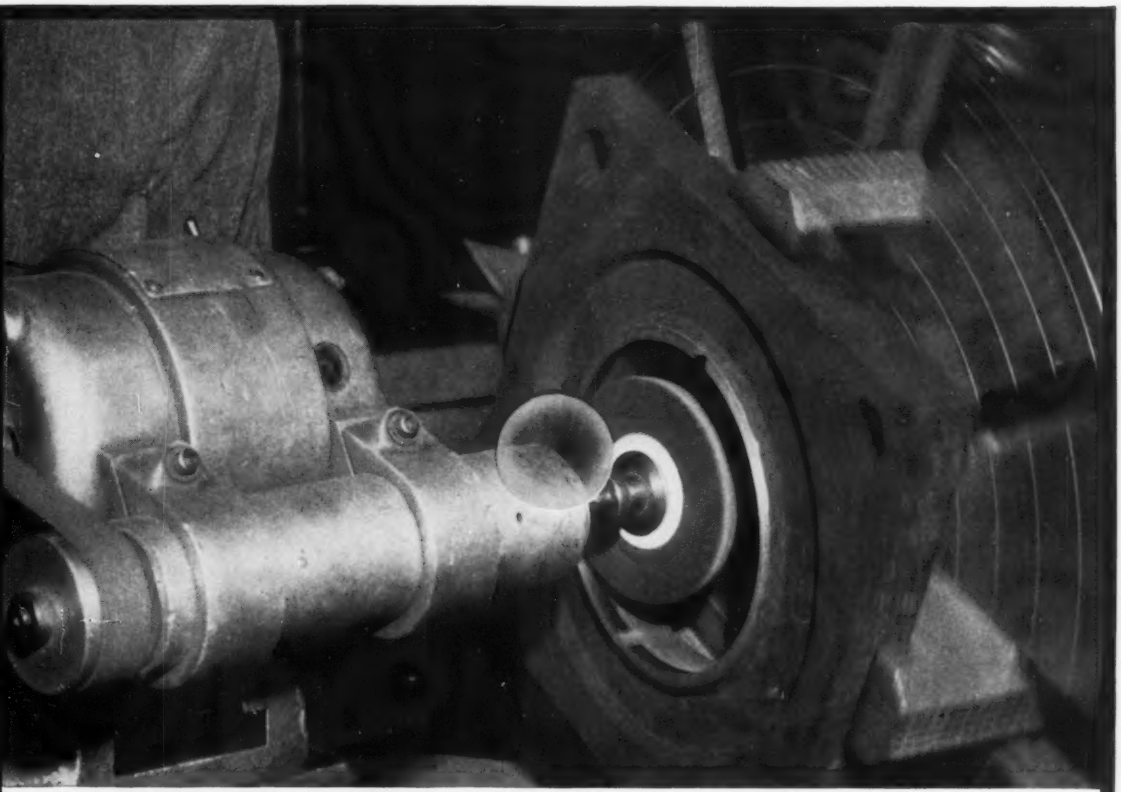
See your CL&T Dealer, or write us direct . . NOW!
Cincinnati Lathe and Tool Co., 3207 Disney Street, Cincinnati 9, Ohio

center on **cincinnati lathes and drills**

ENGINE, TOOLROOM, TRACER AND FIXED GAP BED LATHES AND A COMPLETE LINE OF DRILLING MACHINES

For more information fill in page number on Inquiry Card, on page 223

I.D. grinding job you do



Money-Saving Precision In Toolroom And Miscellaneous Internal Grinding is assured by the completeness of the Norton line — the right abrasive and bond for every type of job on every type of grinder.

W-1819

form better, require less dressing and greatly improve finish.

Whichever of these abrasives you use, team it up with the Norton G Bond, the most efficient vitrified bond ever developed for accurate production grinding.

When your I.D. grinding is the toolroom type, choose 38 ALUNDUM or 32 ALUNDUM abrasive — the latter especially for the more-difficult-to-grind steels because of its outstanding ability to penetrate and hold the cut. And with thes two famous abrasives, select G or BE bonds — both vitrified.

Your Norton Distributor will gladly arrange a test of these "Touch of Gold" wheels in your plant. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors all around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON

ABRASIVES

Making better products... to make your products better

NORTON PRODUCTS

Abrasives • Grinding Wheels • Grinding Machines • Refractories

BEHR-MANNING DIVISION:

Coated Abrasives • Sharpening Stones • Behr-cat Tapes

NICE BEARINGS

Help Advance

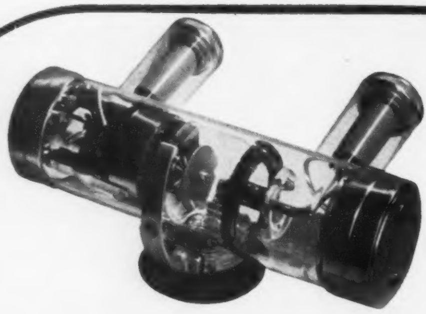
X-RAY DESIGN

Modern techniques in radio-graphic practice have placed new demands on X-ray tube capacity. These demands have been answered by Machlett Laboratories, Inc., Springdale, Connecticut, by the introduction of their DYNAMAX design. The Machlett DYNAMAX design incorporates a rotating anode mounted on highly specialized ball bearings made by NICE BALL BEARING COMPANY.

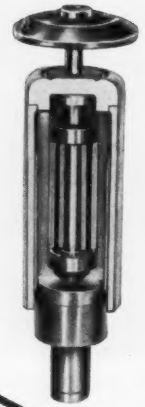
The commercial success of the rotating anode principle is largely due to the development of suitable bearings. The NICE bearings used by Machlett have proven to be the complete answer to all requirement problems. They are made to exacting tolerances from special heat resisting steel and are silver lubricated for use in high vacuum.*

Now Available! New NICE Cat. No. 190

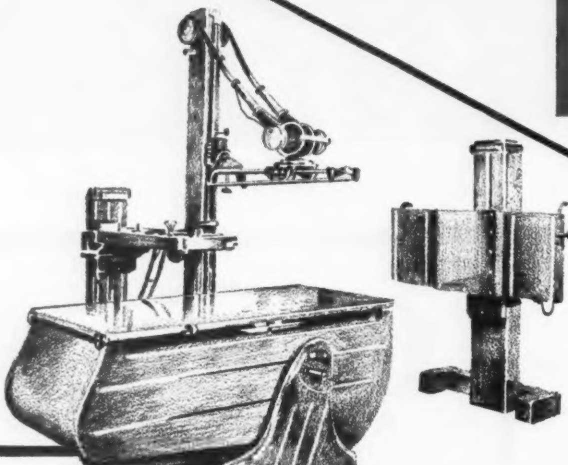
*Machlett U. S. Patent No. 2,315,280



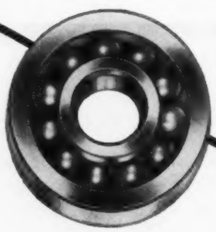
Machlett DYNAMAX "25" Retating Anode X-RAY Tube (with plastic display case)



Cutaway View of Ball Bearing Mounted Rotating Anode and Motor Armature Core



Picker X-Ray Corporation Table and Tube-stand incorporating Machlett DYNAMAX



Special NICE Bearing used at bottom of Rotor. A similar Special Bearing is mounted at top of Rotor.

NICE

NICE is the word for **BEARINGS**

NICE BALL BEARING COMPANY
NICETOWN · PHILADELPHIA · PENNSYLVANIA

For more information fill in page number on Inquiry Card, on page 223

*Ichabod Crane and his Legend of Sleepy Hollow, originators of the throw-away head!

T-J Reamers

have throw-away heads, too!

New Exclusive Design Cuts Replacement Costs More Than Half!

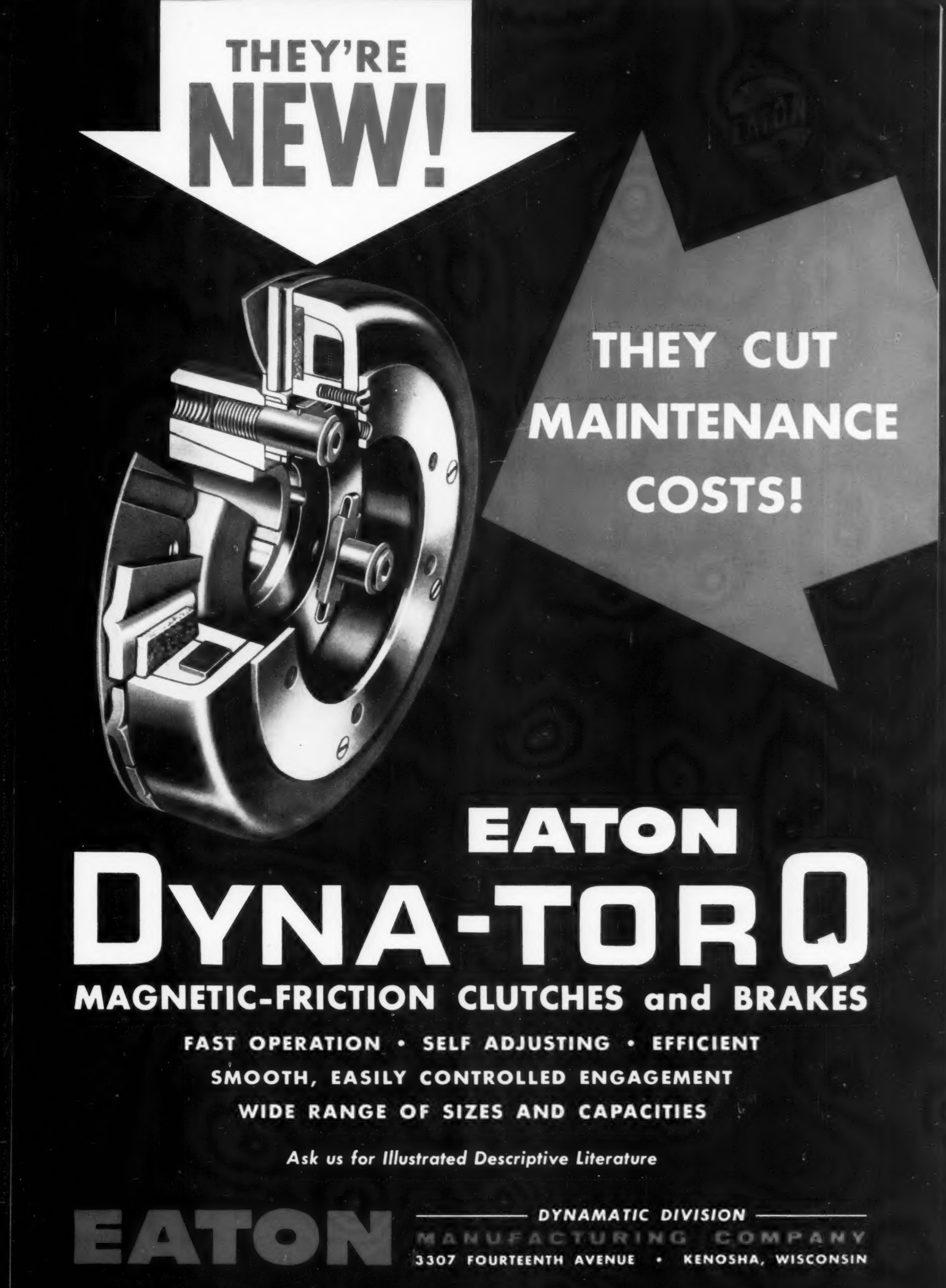
Exclusive in design . . . the New-type T-J Reamers cut your replacement costs *more than half!* Only the quickly installed *head* to replace, after buying original shank. Wide range of interchangeable heads from ½" to 2¾" inclusive, in 1/16" increments are available with right or left hand spiral flutes for thru or blind hole reaming.

Tapered hole in head insures concentricity and *new* thread design assures a snug fit on smoothly ground tapered shank. Reamer operates free from binding or sticking due to cutting portion wearing undersize and creating negative relief. Backed by T-J's 40 years of know-how as one of the largest manufacturers of die sinking milling cutters. Write to Tomkins-Johnson Co., 617 North Mechanic Street, Jackson, Michigan for T-J Catalog #153-1.

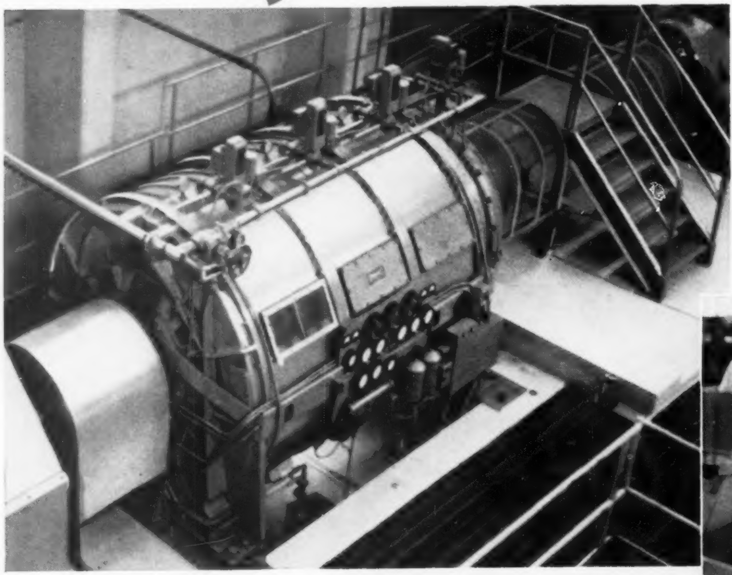
T-J TOMKINS-JOHNSON
RIVITORS AIR AND HYDRAULIC CYLINDERS CUTTERS CLINCHORS

TOMKINS-JOHNSON CO., Jackson, Mich.

For more information fill in page number on Inquiry Card, on page 223

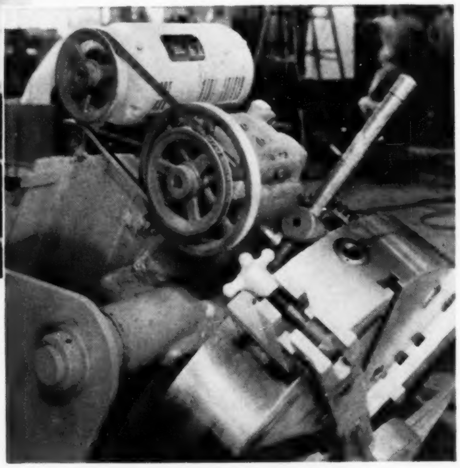

THEY'RE
NEW!
THEY CUT
MAINTENANCE
COSTS!
EATON
DYNA-TORQ
MAGNETIC-FRICTION CLUTCHES and BRAKES
FAST OPERATION • SELF ADJUSTING • EFFICIENT
SMOOTH, EASILY CONTROLLED ENGAGEMENT
WIDE RANGE OF SIZES AND CAPACITIES
Ask us for Illustrated Descriptive Literature
EATON
DYNAMATIC DIVISION
MANUFACTURING COMPANY
3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

20,000 H.P.



OR

¼ HORSEPOWER

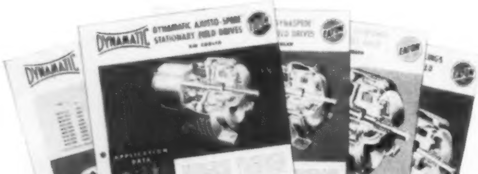


EATON

DYNAMATIC

®

Eddy-Current Equipment Can Solve Your Adjustable Speed Drive Problem



Write today for illustrated bulletins describing Dynamatic Eddy-Current Couplings and Drives—the modern method of speed control.

Need a big 20,000 horsepower drive? Or a compact, low-cost ¼ horsepower drive? For either requirement—or for any of the thousand-and-one applications between these extremes—Dynamatic Eddy-Current Drives, Couplings, and Brakes provide the ideal solution to difficult speed or torque control problems. Their efficiency and economy are being proven every day in every major industry—in both plant equipment and end product applications. Dynamatic equipment offers such important advantages as instantaneous response, infinitely adjustable speed control, wide speed range, quiet operation, low power loss, low maintenance costs, and adjustable speed from an AC power source.

EATON —DYNAMATIC DIVISION—
MANUFACTURING COMPANY
3307 FOURTEENTH AVENUE • KENOSHA, WISCONSIN

how A. O. SMITH *reduces to careful analysis their cost savings opportunities . . .*

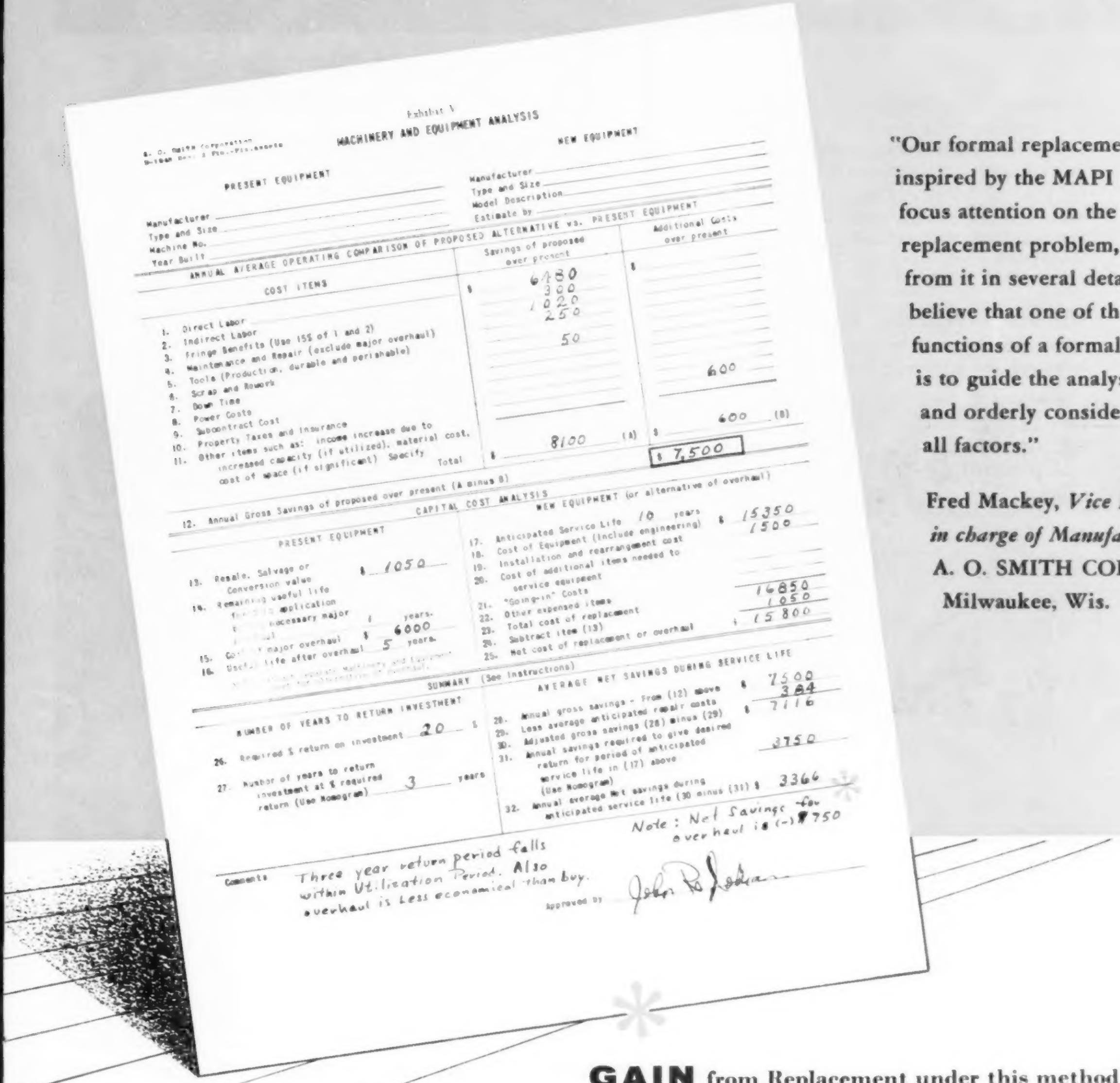


Exhibit V

A. O. Smith Corporation

MACHINERY AND EQUIPMENT ANALYSIS

PRESENT EQUIPMENT

Manufacturer
Type and Size
Machine No.
Year Built

NEW EQUIPMENT

Manufacturer
Type and Size
Model Description
Estimate by

ANNUAL AVERAGE OPERATING COMPARISON OF PROPOSED ALTERNATIVE vs. PRESENT EQUIPMENT

COST ITEMS	Savings of proposed over present	Additional Costs over present
1. Direct Labor	$ 6480	$
2. Indirect Labor	300	
3. Fringe Benefits (Use 15% of 1 and 2)	1020	
4. Maintenance and Repair (exclude major overhaul)	250	
5. Tools (Production, durable and perishable)		
6. Scrap and Rework	50	
7. Down Time		
8. Power Costs		
9. Subcontract Cost		
10. Property Taxes and Insurance		600
11. Other items such as: income increase due to increased capacity (if utilized), material cost, cost of space (if significant) Specify		
Total	$ 8100 (A)	$ 600 (B)

12. Annual Gross Savings of proposed over present (A minus B) $ 7,500

CAPITAL COST ANALYSIS

PRESENT EQUIPMENT

13. Resale, Salvage or Conversion value $ 1050
14. Remaining useful life for present application without necessary major overhaul 1 years.
15. Cost of major overhaul $ 6000
16. Useful life after overhaul 5 years.

NEW EQUIPMENT (or alternative of overhaul)

17. Anticipated Service Life 10 years $ 15350
18. Cost of Equipment (include engineering) 1500
19. Installation and rearrangement cost
20. Cost of additional items needed to service equipment
21. "Going-in" Costs 16850
22. Other expensed items
23. Total cost of replacement
24. Subtract item (13) 1050
25. Net cost of replacement or overhaul $ 15800

SUMMARY (See Instructions)

NUMBER OF YEARS TO RETURN INVESTMENT

26. Required % return on investment 20 %
27. Number of years to return investment at % required return (Use Nomogram) 3 years

AVERAGE NET SAVINGS DURING SERVICE LIFE

28. Annual gross savings - From (12) above $ 7500
29. Less average anticipated repair costs 384
30. Adjusted gross savings (28) minus (29) $ 7116
31. Annual savings required to give desired return for period of anticipated service life in (17) above (Use Nomogram) 3750
32. Annual average Net savings during anticipated service life (30 minus (31)) $ 3366

Note: Net Savings for overhaul is (-) $750

Comments Three year return period falls within Utilization Period. Also overhaul is Less economical than buy.

Approved by John R. [illegible]

"Our formal replacement policy was inspired by the MAPI efforts to focus attention on the equipment replacement problem, but differs from it in several details. We believe that one of the important functions of a formal work-sheet is to guide the analyst into full and orderly consideration of all factors."

Fred Mackey, *Vice President in charge of Manufacturing*
A. O. SMITH CORPORATION
Milwaukee, Wis.

GAIN from Replacement under this method is
. . . after the return on the new investment
. . . after allowance for future absolescence of new equipment.

ROCKFORD INSERT GROUP

Keep gathering metal-working production ideas . . . be well informed when you replace machinery

"Engineered Production" Service

FOR BROACHING

It takes all 3

American's "Engineered Production" Service . . . gives the broach-user the complete three-part service that is essential to obtain the most practical broaching method. Years of design and production engineering experience, unavailable at any price, are effectively added to your staff at no extra cost.

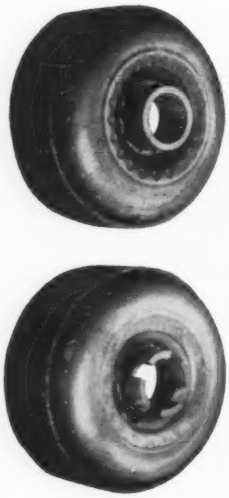
THE JOB—Broaching ½ inch wide cross slots in torus part with machine arranged for conveyor line operation.

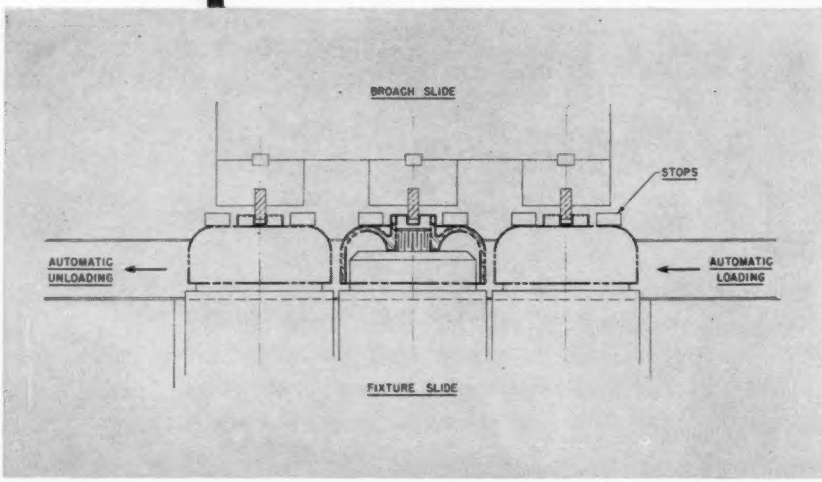
THE RESULT—400 completed parts per hour with two operations performed on each part. Parts are broached three at a time.

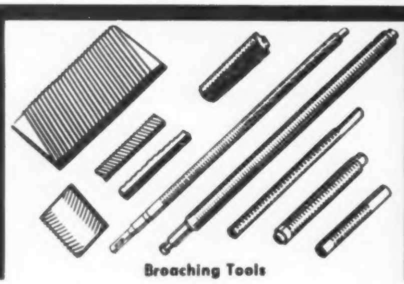
1

PROPER BROACH TOOL DESIGN

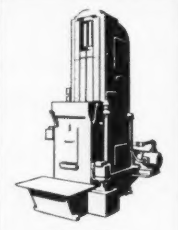
Top-quality results on any broaching operation require starting the job with design of the broaching tool itself. In solving this all-important first step, American Broach considers stock removal, length and width of cut, finish tolerances required, etc. High-quality work and long tool life result because broach and machine are designed to operate as a team. Sectional surface broach assemblies used on this job are HSS approximately 50" long. Return of broaching tool to cutting position is timed to coincide with the backward movement of the fixture.



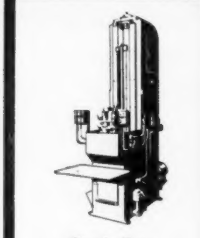




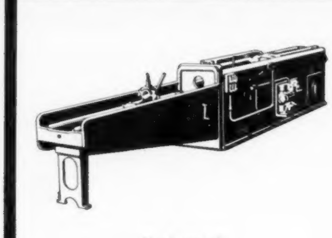
Broaching Tools



Three Way



Single Ram



Horizontal

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

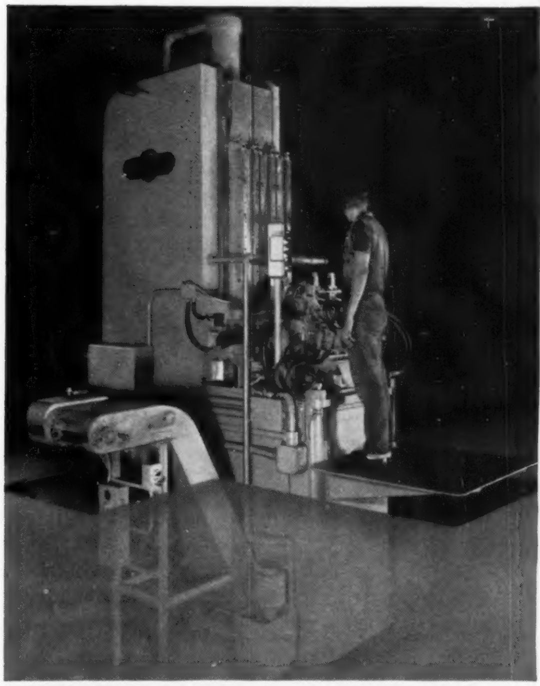
to give you peak broaching performance

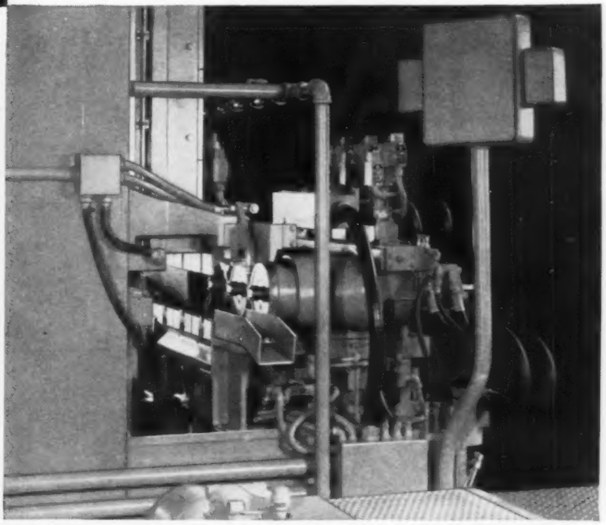
2 SPECIFYING THE RIGHT MACHINE

Production rate required, length and speed of stroke, relationship to other production machinery, available floor space, etc. determine the selection of the broaching machine capable of doing the best job. At American, machine selection follows design of the broaching tool. This vertical hydraulic single-ram surface broaching machine is equipped with an automatic transfer mechanism that carries three parts from the conveyor line into broaching position and ejects them after broaching. Interlock prevents machine operation unless three parts are in the transfer mechanism.

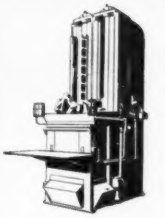
3 EFFICIENT FIXTURING

Whatever your part geometry or hourly needs, fixturing by American Broach forms the vital third link in the production chain. The three-station fixture shown in the close-up provides positive clamping of the workpiece for broaching. In addition, it recedes at the end of each broaching pass and indexes 90 degrees for the second pass. On high-volume jobs like these, even with relatively inexperienced operators, production schedules are maintained because the "skills" are built into the tool, machine, and fixtures.

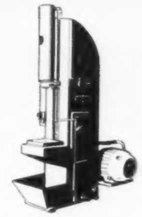




For more information on practical broaching methods, write for Bulletin A617.



Duplex Ram



Presses

American

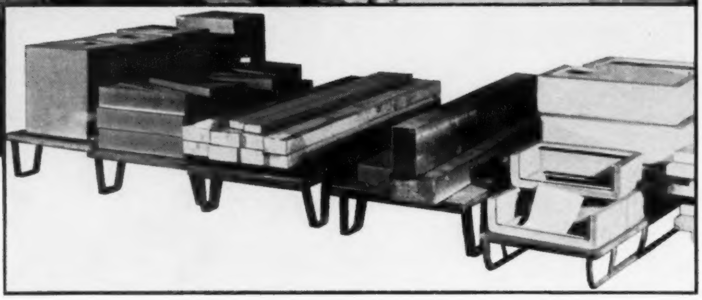
SUNDSTRAND BROACH & MACHINE DIVISION

SUNDSTRAND MACHINE TOOL COMPANY

ROCKFORD, ILLINOIS

FOR PRODUCTION MACHINE TOOLS IT'S ROCKFORD, ILLINOIS, U.S.A.

Improve Milling Methods and Cut Costs with SUNDSTRAND Rigidmils and *"Engineered Production"* Service.



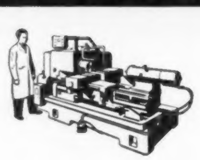
Small Lot Milling

From 4 to 35 pieces per lot yields big savings on this standard Model 55 Rigidmil equipped with Sundstrand universal magnetic fixture. It takes just 12 hours to mill top, bottom and sides of 20 rotary table segments, compared with 22 hours required by former method. Some of the other jobs handled on this machine are shown above.

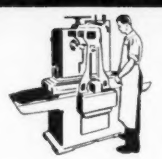
SUNDSTRAND "Engineered Production Service"*

*REG. U.S. PAT. OFF.

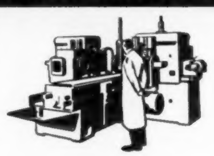
AUTOMATIC LATHES



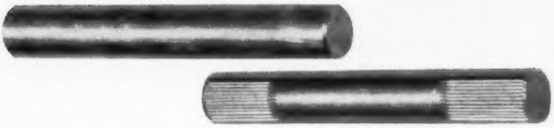
SIMPLEX RIGIDMILS

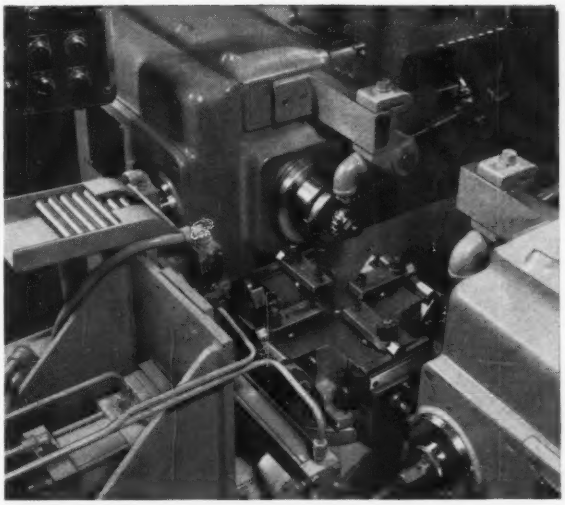


DUPLEX RIGIDMILS



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

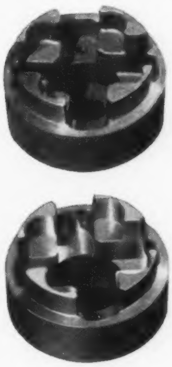




High-Production Milling...

Serrations on both ends of brake pedal shafts are milled automatically at the rate of 200 pieces per hour on this Duplex-type Sundstrand Rigidmil. Automatic 4-position index base and power-operated fixture increase efficiency and reduce burden on operator. All he needs to do is keep hopper loaded with rough parts.

Special Milling...



of 8 pockets with various depths and diameters is performed automatically in transmission rear brake drums on this Sundstrand 9-station special Rigidmil. Only operator requirement is to load and unload parts at the idle station. Work is carried to successive machining stations by automatic index unit. Automatic chip removal unit keeps all work areas clear.

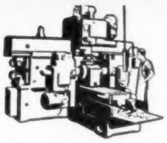
Sundstrand's "Engineered Production" Service offers years of design and production engineering experience coupled with the availability of a wide range of standard milling machines to assure you of getting the most practical milling method.

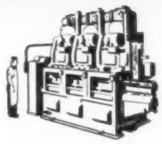
Whether your production requires: (1) a standard Rigidmil, (2) a semi-standard Rigidmil, or (3) a machine designed specially for your job — with Sundstrand you know you'll get the one best answer. Examples shown here illustrate a few jobs with varied production rates being handled with maximum efficiency on Sundstrand Rigidmils.

Sundstrand's "Engineered Production" Service is available to you without obligation. Send a part or part print to Sundstrand's engineering department, or to the field office nearest you to get an "Engineered Production" analysis. You too, will agree that its the sure way to keep costs down, quality high, and production up.

"Engineered Milling Production" data is available in Bulletin No. 682. Write for your copy today.

TRIPLEX RIGIDMILS | **SPECIAL MACHINES**





SUNDSTRAND
Machine Tool Co.
2530 Eleventh St. • Rockford, Ill., U.S.A.

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

push button control

speeds operation and set-up on new Rockford **hydraulic** slotter

All longitudinal, transverse and rotary movements are selected and operated from the push button station of this new Rockford hydraulic Slotter.

The ram lock is pendant operated and ram stroke length and position are completely push button controlled.

Two-speed table traverse is available, enabling the machine operator to position the work to a few thousandths, without manual movements, although manual control of all movements is available from either side of the machine.

Full hydraulic drive provides two cutting ranges, one for high speeds and low cutting forces; the other for slow speeds and heavy cuts.

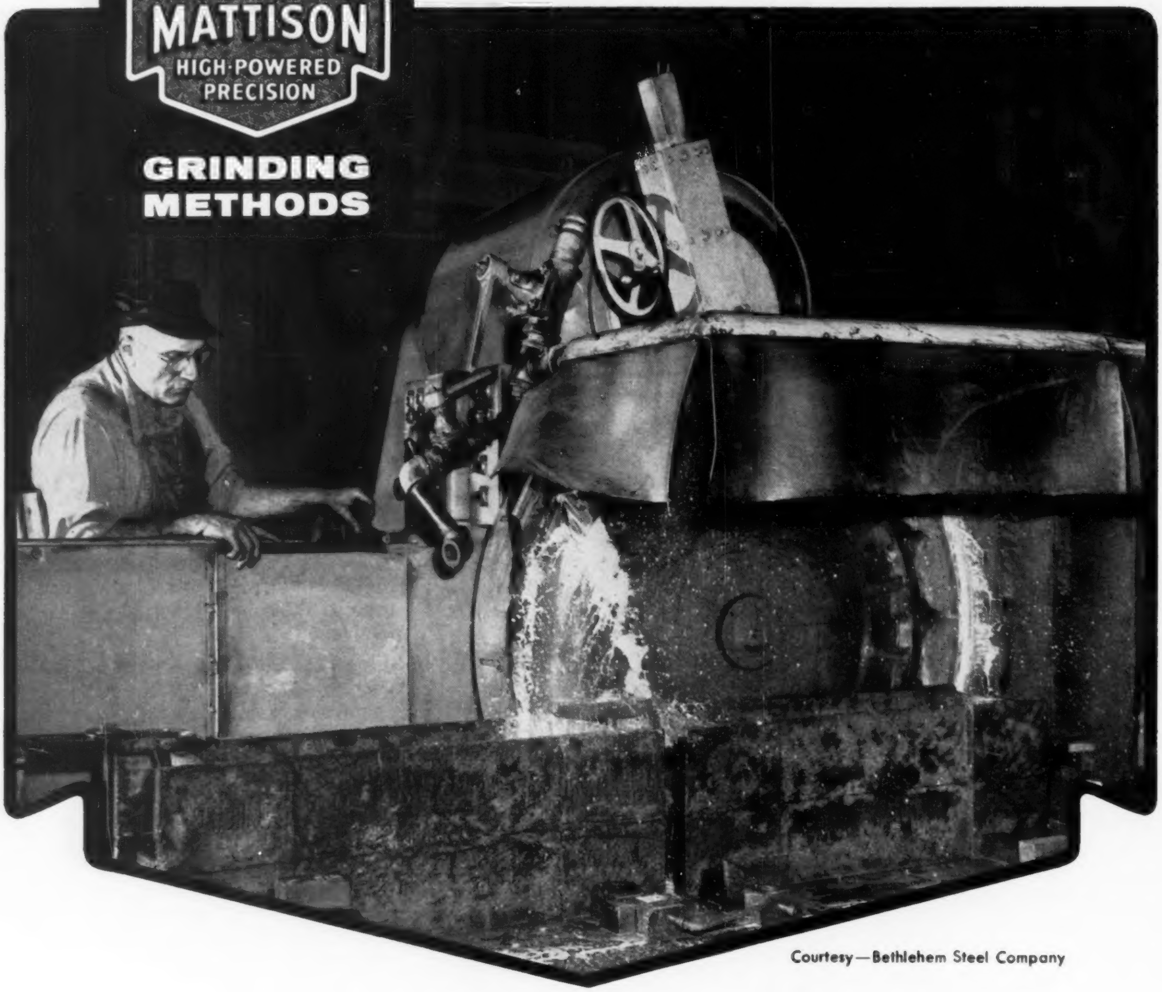
Get full details on this new hydraulic slotter from any Rockford Machine Tool Co. representative, or write directly to us.

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

MATTISON
HIGH-POWERED PRECISION

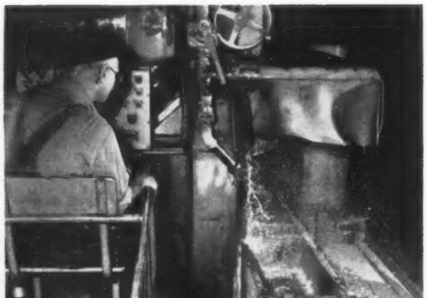
GRINDING METHODS

CASE HISTORY No. 33—CAST STEEL BRAKE BASES



Courtesy—Bethlehem Steel Company

Switch from planer to face grinder boosts production 200 to 300 per cent



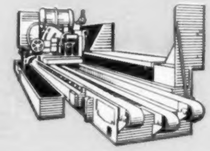
All controls are conveniently located in front of the operator. Skill requirements have been reduced on many jobs in this plant.

Large cast steel brake bases, formerly machined on a planer, are finished three to four times as fast and more efficiently on this Mattison "UK" Traveling Wheel Face Grinder. Surface finish has been improved considerably, and it is now easier to machine the brake bases to required accuracy limits. The machine is so simple to operate and easy to set up, operator skill requirements have been reduced with resultant savings in direct cost.

Many jobs formerly done on a planer or milling machine are now being machined faster and more efficiently on the Mattison "UK." The large traveling wheel—feeding at the end of each stroke—takes a positive cut and covers the entire work surface on each pass. All cuts are finishing cuts, whereas first operations on the planer or milling machine had to be roughing cuts.

This Mattison Face Grinder offers an excellent solution to the problem of grinding large, heavy, and over-length parts. Floor space required is only half that needed for a traveling table machine. Write for Bulletin No. 844.

IF IT'S A FLAT SURFACE THERE IS A MATTISON TO GRIND IT

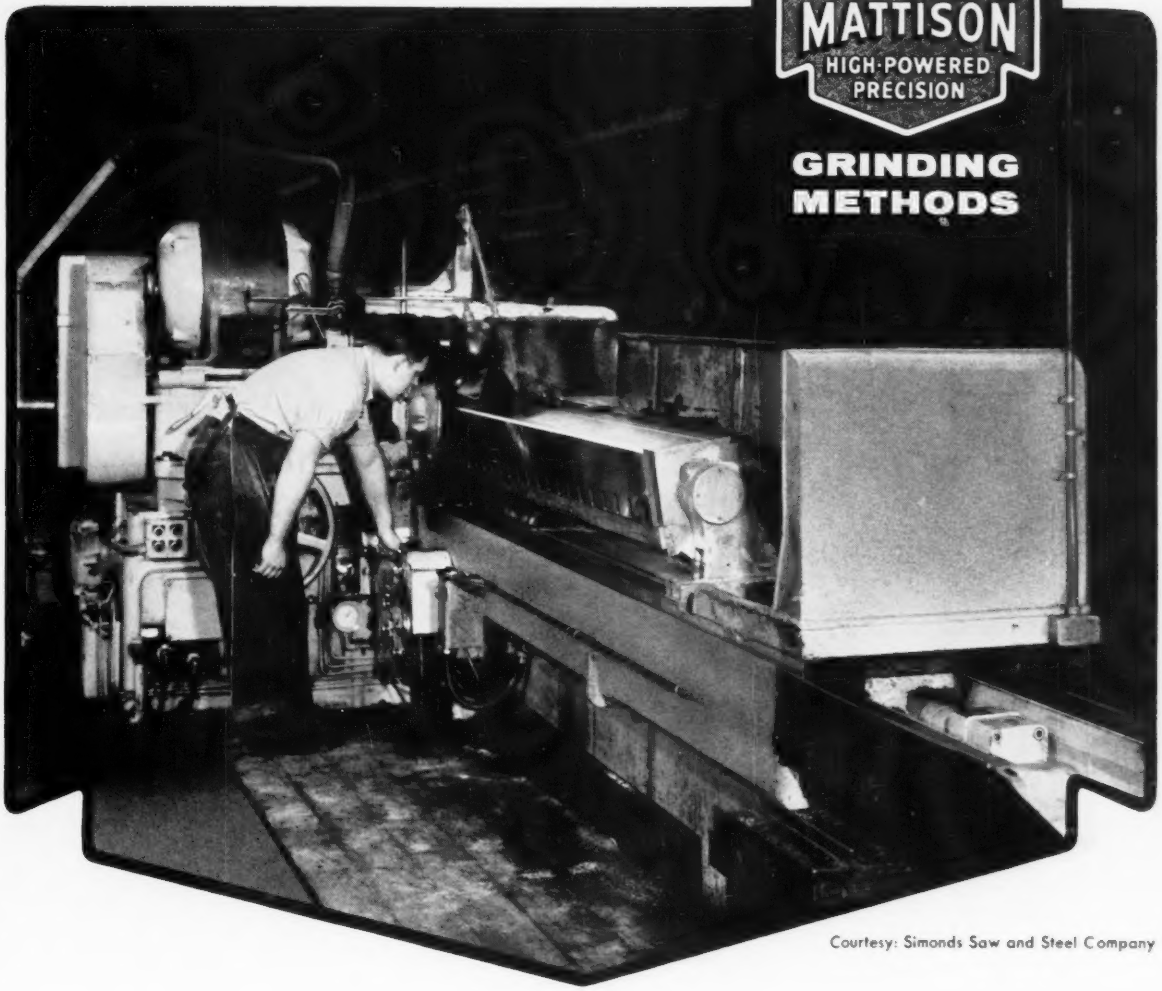


MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

CASE HISTORY NO. 34—CARBON STEEL KNIVES

MATTISON
HIGH-POWERED PRECISION

GRINDING METHODS



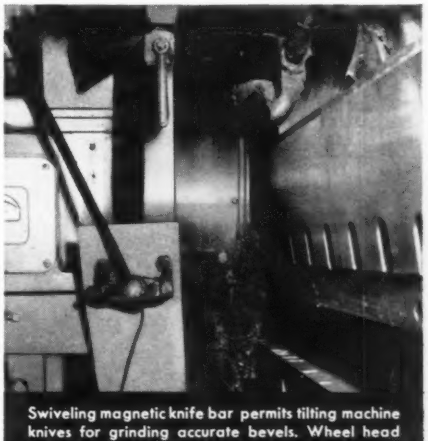
Courtesy: Simonds Saw and Steel Company

Face-grinding accurate bevels on machine knives ...loading and unloading simplified!

For quick setups on long, narrow work, a Mattison Traveling Table Face Grinder offers many unusual advantages.

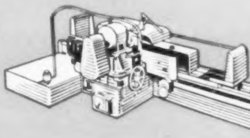
At Simonds Saw and Steel Company, Fitchburg, Mass., this machine grinds accurate bevels on machine knives held on a revolving magnetic knife bar. Open design of the machine makes it easy to load and unload the long carbon steel knives. The high-powered spindle motor permits heavy stock removal, and the heavy-duty spindle is vibration-free, assuring close accuracy under these heavy stock removal conditions.

If you are machining shear blades, pump castings, electric motor frames, generator housings, large bearing caps, or large dies—some of which may now be milled, broached, or machined on a planer—why not do it faster, remove less metal, and get a more accurate job by using a face grinder? Vertical magnetic chucks or swiveling magnetic knife bars reduce fixture costs. All machine controls are centralized for fast, efficient operation. Write for Bulletin No. 846.



Swiveling magnetic knife bar permits tilting machine knives for grinding accurate bevels. Wheel head feeds after each forward and reverse stroke.

MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.

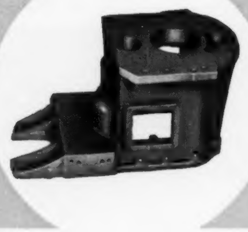


HIGH-POWERED PRECISION SURFACE GRINDERS

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

5 DIFFERENT WORKPIECES PROCESSED ON ONE W. F. & JOHN BARNES SPECIAL MACHINE

1



2

3

4

5

Versatile Tooling and Special Machine Precision Lower Costs, Improve Quality of Motor Grader Transmissions

This W. F. & John Barnes unit, designed and built for the J. D. Adams Manufacturing Co., Indianapolis, Ind., combines all the built-in advantages of a special machine . . . yet it machines not one, but FIVE separate and dissimilar workpieces that together form a complete transmission housing. Ingenious planning of spindle arrangement, tooling, and fixtures enables only 31 spindles to perform a total of 53 operations on the five workpieces. Special fixtures and numbered gauges locate the work and tooling quickly and accurately . . . complete change-over from one housing section to another averages only six hours.

Engineering and building a distinctive machine like this just doesn't happen by accident . . . it's the result of over 75 years of accumulated knowledge in a highly specialized field. That's why at Barnes you'll find the creative skills, plus complete and adequate facilities, for designing and building better machines to lower your production costs . . . improve product quality.

ASK FOR AN ANALYSIS OF YOUR PRODUCTION METHODS

Find out how Barnes' unique creative and specialized resources can help you cut costs. Your problem will be given expert and individual attention.

W. F. & JOHN BARNES

BUILDERS OF BETTER MACHINES SINCE 1879

MULTIPLE SPINDLE DRILLING • BORING • TAPPING

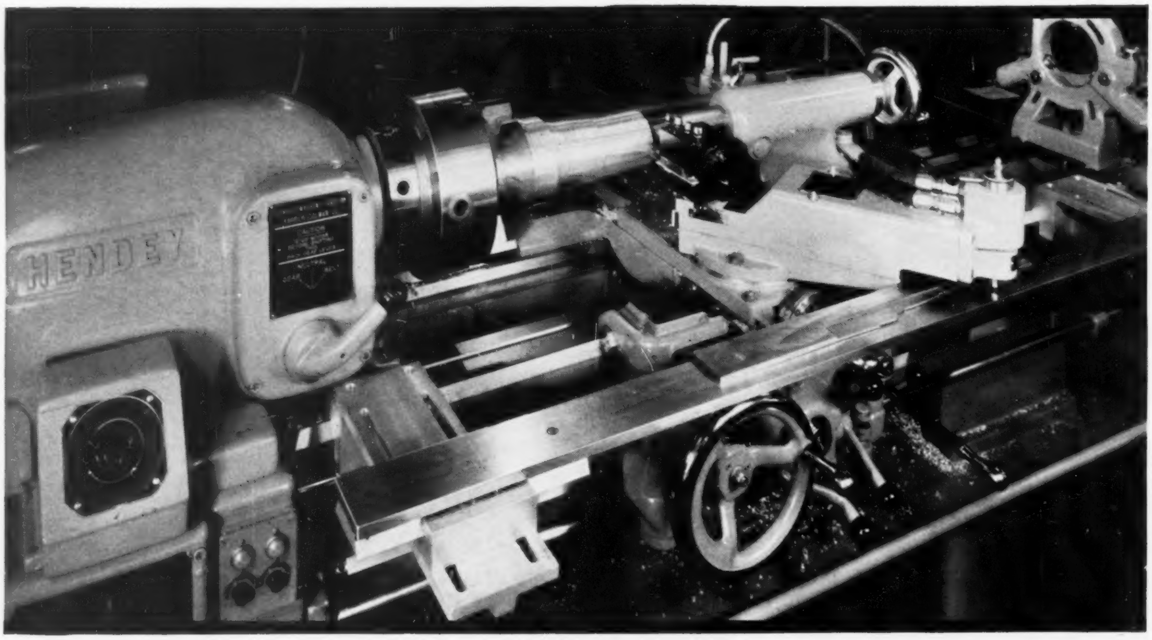
CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.

You get

top value per dollar

with a Hendey No. 2E lathe

QUICK-CHANGE tracer attachment CUTS CONTOUR TURNING COSTS!



The precision performance and fast, easy setup of the new hydraulic tracer control introduce previously unheard-of economy wherever three or more pieces are to be step-turned. Available as optional equipment, the new tracer is a packaged unit which simply replaces the standard compound . . . no drilling required. Mounts on front of lathe where the flat template stays clear of chips and coolant.

The Hendey No. 2E is widely known as the multi-feature lathe offering top value at moderate cost. Electronic drive with fingertip stepless speed control gives unmatched ease of precision production and makes the Hendey No. 2E ideal for hydraulic tracer control. Contact your Hendey dealer for details and specifications.

for precision with production, buy Hendey

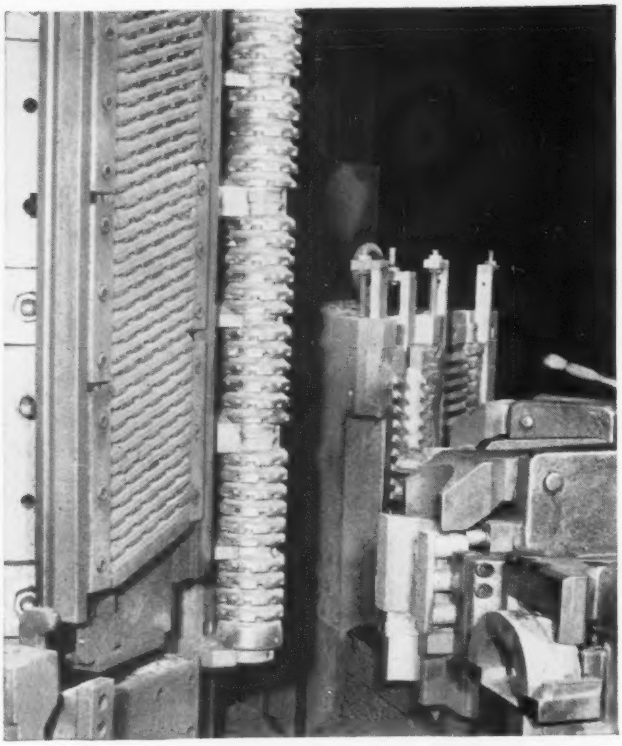
Hendey machine division

BARBER-COLMAN COMPANY

82 Loomis St., Rockford, Illinois

BARBER COLMAN ®

MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.



Grade 883 increases broach life 2500%

Highly abrasive cast iron used for this bearing cap at Studebaker caused conventional broaches to fail after maximum run of only 3,600 parts. After the switch to Grade 883, initial broach ran 50 days, produced 90,000 parts without service. Over-all machining costs were reduced 22%.

Grade 370 saves 155 hours' machining time

Normal machining time on this 165-ton cast-steel propeller runner at S. Morgan Smith Co. was 220 hours. Despite abrasive patches, and interrupted cuts, Grade 370 cut machining time to 65 hours – 1/3 the time. At 154 fpm, Grade 370 ran 30 hours without changing – compared to 6-8 hours with previous tools.

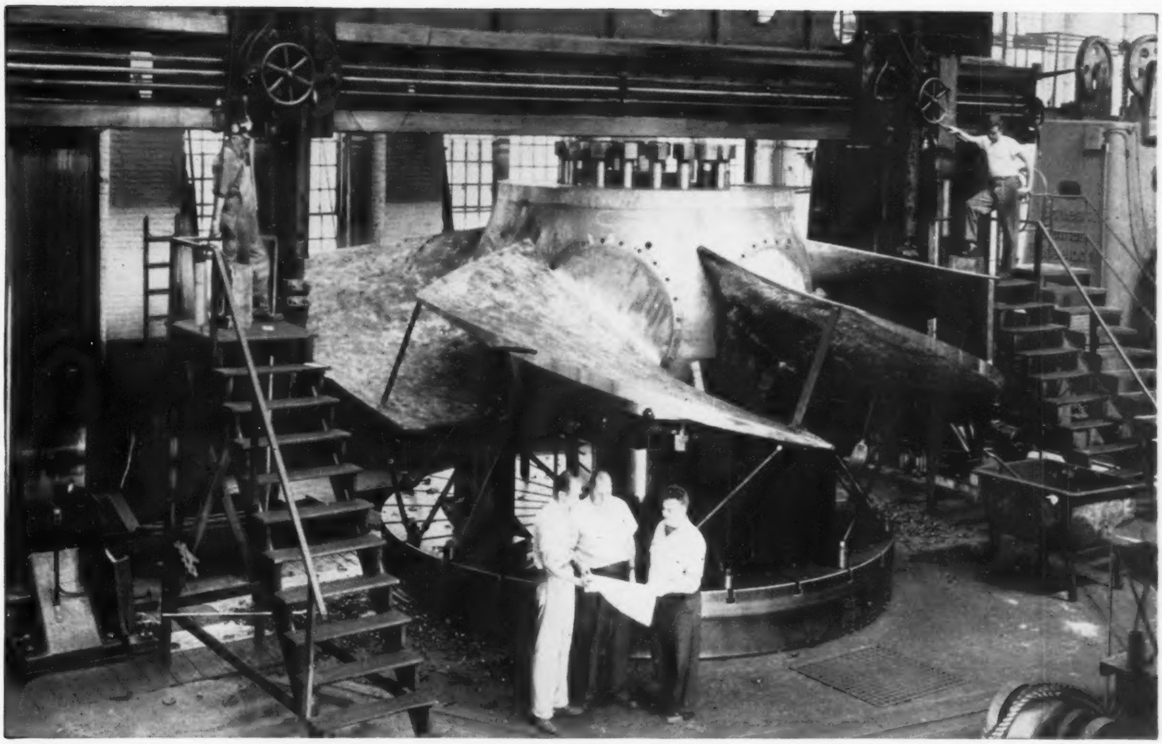
WHY MACHINE OUTPUT GOES UP, WITH CARBOLOY® CARBIDES ON

Grades for cutting every material

Eleven grades to choose from: 300 Series and 78 Series carbides for cutting steel; new Grade 860 for cast iron; five grades for nonferrous machining.

. . . in a form for handling every job

Standard tools in thirteen styles, hundreds of sizes; standard blanks in wide range of styles and sizes. Inserts for Carboloy toolholders or other standard types.



AND UNIT COST COMES DOWN, YOUR METALCUTTING JOBS

▶ Carboloy cemented carbides are tailored to the job

▶ Let you cut faster without sacrificing tool life

You'll increase the productivity of your machines, while you reduce total manufacturing cost per piece, when Carboloy cemented carbides go to work on your jobs.

Your machines will be more productive, because they can operate at greater speeds and feeds when tooled with the Carboloy grade designed for the job. And they'll produce more per shift, because Carboloy carbides take rugged machining conditions without sacrifice of tool life.

Your units costs will go down, because the use of these grades means less machining time per piece . . . with lower downtime expense, reduced grinding and maintenance charges.

Proved in the field

Hundreds of inplant case histories like the two shown above prove Carboloy cemented carbides can double and triple output, save thousands of dollars per year in machine time, manpower, and tool costs.

The reason is simple. Each Carboloy carbide grade has cutting characteristics tailored to a particular type of job. Whether you're machining ferrous or nonferrous metals, whether you're taking heavy or finishing cuts . . . one of the eleven Carboloy carbide grades handles the job. And you can quickly get the *grade* you need, in the *form* you need it.

Stocked locally by Carboloy Distributors

Your local Authorized Distributor of Carboloy cemented carbide products stocks standard tools, blanks, inserts, and toolholders in styles and sizes for every job or machine. He'll give you fast delivery, and expert technical assistance.

Call him today (you'll find his name in the Yellow Pages of your phone book). Or write: *Metallurgical Products Department of General Electric Company, 11147 E. 8 Mile Street, Detroit 32, Michigan.*

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC

For more information fill in page number on Inquiry Card, on page 223

Increase the availability of your automatic forging equipment ...at no extra cost!

IF you've invested in automatic forging equipment, don't be robbed of your profits by the steel you're forging. Unless it's uniform, you'll be interrupting production to change your setup. These interruptions take time, limit the availability of expensive automatic equipment.

When you use Timken® steel, you get the uniformity you need. Timken fine alloy steel is uniform from bar to bar, heat to heat, order to order. It makes your automatic forging equipment more available—at no extra cost—because you can forge without interruption.

We assure complete uniformity by taking extra quality control steps. For example, we were the first steel manufacturer in the U.S. to use a magnetic stirrer for molten steel. It distributes alloys equally, keeps temperature uniform, and works the slag continuously.

To assure still further uniformity, your order is handled individually. Conditioning procedures are targeted to meet your end use requirement. To limit variations within an order—as well as from order to order—we stamp each bar to identify its heat.

To increase the availability of your automatic forging equipment —at no extra cost—always specify Timken fine alloy steel. You'll get money-saving performance and uniform results every time. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

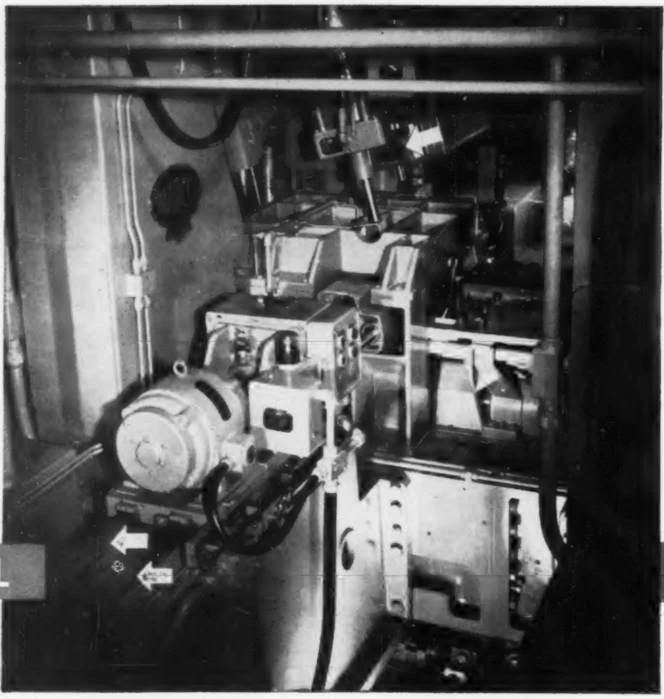
For more information fill in page number on Inquiry Card, on page 223

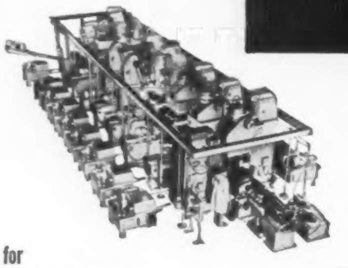
50 Auto Blocks An Hour!

WITH THE HELP OF

Allegheny Ludlum

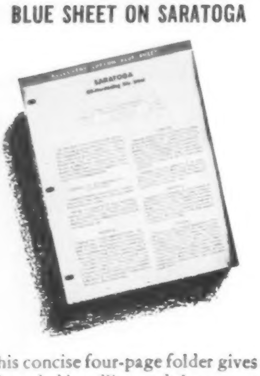
SARATOGA TOOL STEEL





Allegheny Ludlum Saratoga was used for the steel ways (note arrows, above) of this giant unit, illustrated at left in a bird's-eye view reduced to miniature size.

Write for BLUE SHEET ON SARATOGA



This concise four-page folder gives all needed handling and shop treatment details on Saratoga. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. *Ask for your copy.*

ADDRESS DEPT. M-92

98 SEPARATE OPERATIONS are carried on by this versatile machine which turns out 50 V8 auto engine blocks an hour. It consists of 18 machining units, each of which is fitted with hardened and ground steel ways of A-L Saratoga to guarantee accuracy in production.

MILLING, TREPANNING, DRILLING, counterboring, reaming, chamfering, automatic inspection of holes for depth and removal of chips are the operations performed by this amazing mechanism.

SARATOGA WAS USED BECAUSE its extreme hardness, high resistance to wear, and excellent machinability more than met the customer's high requirements for maintaining accuracy in this huge, multi-station machine.

ALLEGHENY LUDLUM METALLURGICAL SERVICE can solve *your* tool or die steel problems. ● Call your local A-L representative or distributor, or write *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania.*

For nearest representative, consult Yellow Section of your telephone book.

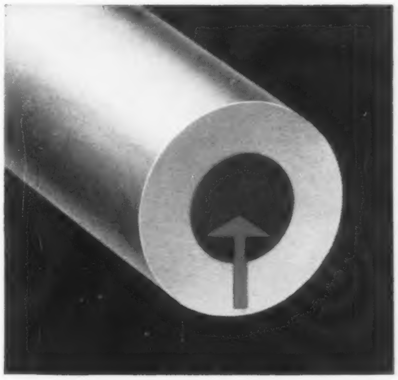
For complete **MODERN** Tooling, call

Allegheny Ludlum

A-L FINE TOOL STEELS SINCE 1854 ®

WSW 6385

For more information fill in page number on Inquiry Card, on page 223



a hole here is a hindrance... a hole here is a help

Crucible Hollow Tool Steel sections, cut to length, save you time and money when you make ring-shaped, or tubular parts, or tools with a center hole. Because these tool steel sections are already drilled through when you get them, you don't have to bore, drill, cut-off or rough-face. Production time goes down, and most scrap losses are eliminated.

Five popular grades of Crucible tool steel are available immediately from warehouse stock, in hollow-disc form. They are KETOS oil-hardening, SANDERSON water hardening, AIRDI 150 high-carbon, high-chromium, AIRKOOL air-hardening, and NU-DIE V hot-work tool steels. Order the O.D. and I.D. combination, and length and thickness you need.

Let your Crucible representative show you how hollow tool steel sections can reduce production time, and save you money. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

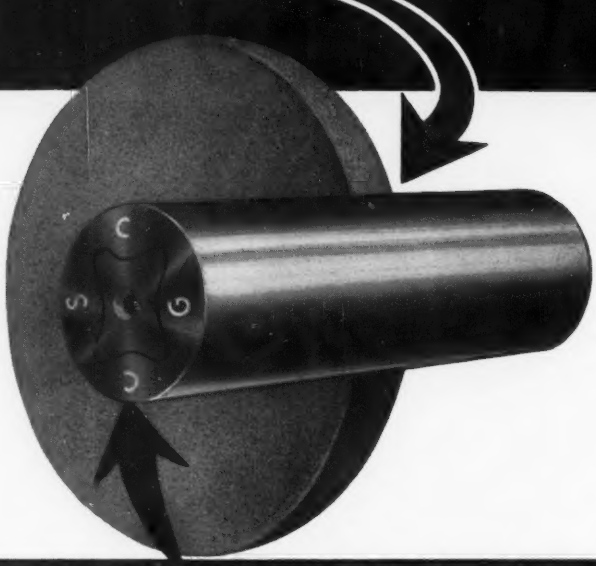
Canadian Distributor—Railway & Power Engineering Corp., Ltd.

An exclusive GRINDING PROCESS...

makes

CUMBERLAND
STEEL BARS

concentric, straight,
smooth & *really* accurate



BE SURE OF THIS MARK ON THE END OF YOUR SHAFTS

CUMBERLAND GROUND BARS FOR ALL TYPES OF MACHINES

They are carefully ground to our standard manufacturing tolerance, plus nothing to minus .002″ on diameters 1-1/8″ to 2-7/16″ inclusive . . . plus nothing to minus .003″ on diameters 2-1/2″ to 8″ inclusive. Closer tolerance can be furnished, if desired. And, remember, Cumberland Steel Bars are the end result of 109 years' experience,—and every bar is *carefully tested* before shipment. The list of Cumberland's customers reads like the "Blue Book" of Industry. Ask for further information.

MANUFACTURED IN THREE SPECIFICATIONS

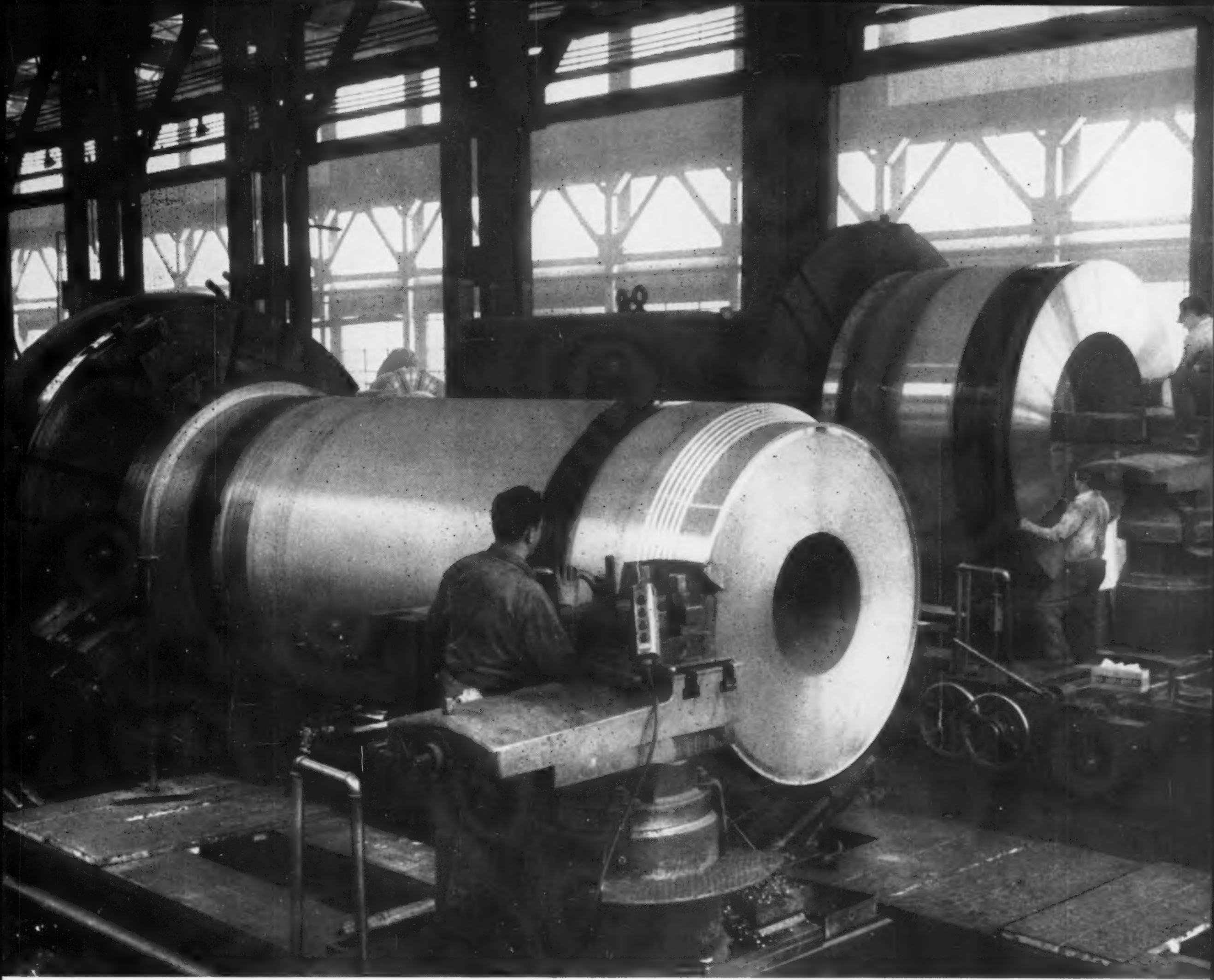
Cumberland Brand—AISI C-1020/C-1025, Elastic Limit 30,000# Min.
Potomac Brand—AISI C-1040, Elastic Limit 45,000# Min.
Cumsco Brand—AISI C-1141, Elastic Limit 57,000# Min.

CUMBERLAND STEEL COMPANY

CUMBERLAND, MARYLAND, U.S.A.

ESTABLISHED 1845 **INCORPORATED 1892**

For more information fill in page number on Inquiry Card, on page 223



Here's where the Heavyweights Shape Up

This is the No. 8 Machine Shop of our Bethlehem, Pa., plant—a shop that has seen some of the world's heaviest forgings come and go. Here giant forged parts are machined to precise dimensions, checked and rechecked, groomed and pampered.

The two cylinders in the photograph are typical Bethlehem press forgings of the heavyweight class. The one in the foreground is the main cylinder for a 3500-ton extrusion press. It has an overall length of approximately 15 ft and an OD of 6 ft 1 in. It weighs 66 tons. Its squat neighbor in the background, shorter and several tons lighter, is intended for another type of press.

Forgings of this kind always take weeks to produce. The making of the steel, the forging, the heating and cooling, the slow, careful machining—all are steps demanding the highest technical skills.

But not all Bethlehem skills are reserved for the making of heavy-tonnage items. Bethlehem shops produce every size and type of steel forging ever required—right down to the midgets weighing only a pound or so. When you are next in the market, by all means give us a call.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

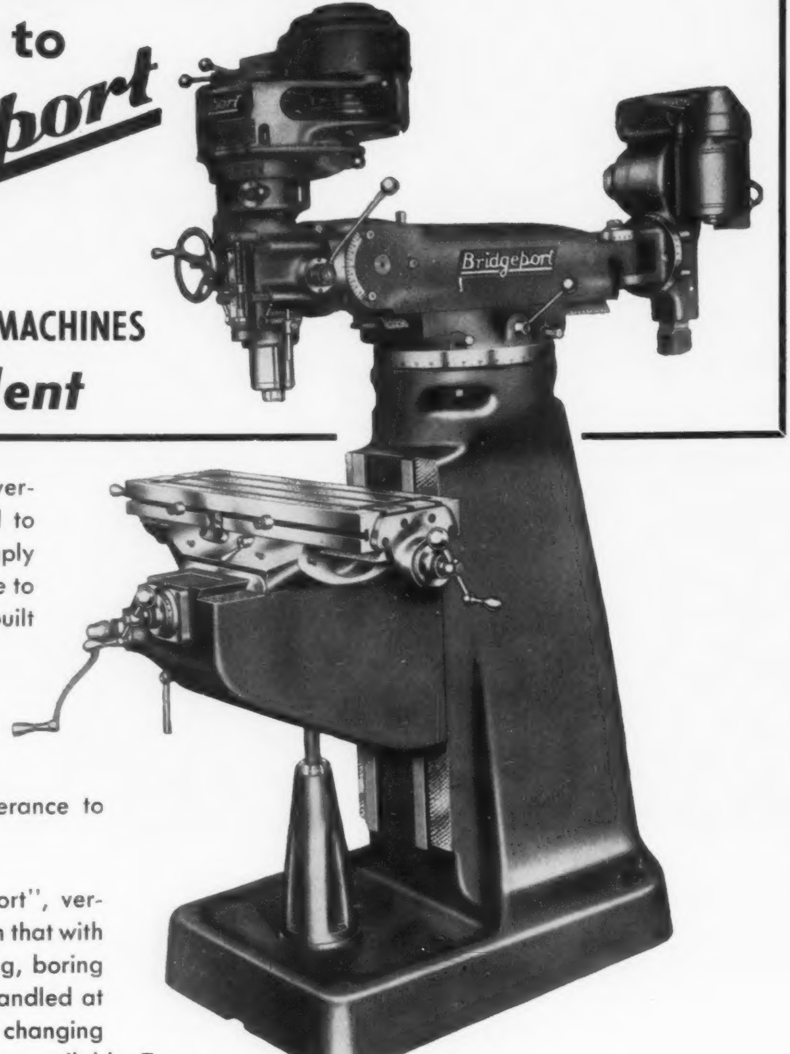
"Greatest Value"

as applied to

Bridgeport

TURRET MILLING MACHINES

is no accident



And the reason for this universally descriptive term applied to "BRIDGEPORT MILLERS" is simply and briefly because, from base to turret, they are designed and built with "greatest value" the objective in their specifications.

For example, precision is of highest order and components are held to closest tolerance to achieve this objective.

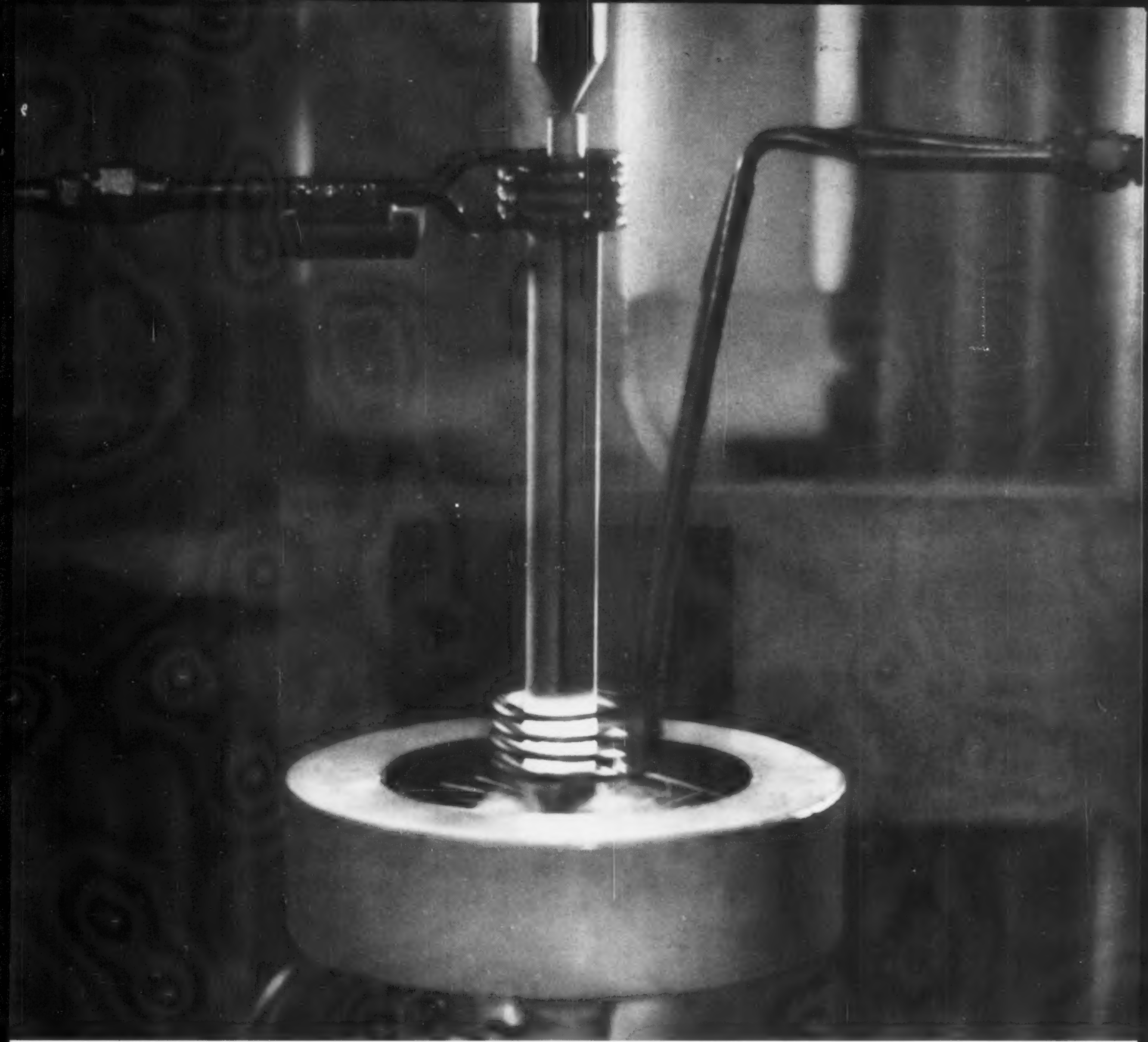
Then, too, with the "Bridgeport", versatility contributes to "value" in that with these machines, milling, drilling, boring and shaping are operations handled at all angles of the work without changing set-up. And with the recently available True Trace Hydraulic Duplicator attachment, the "BRIDGEPORT" offers excellent performance and outstanding savings in time in copying such parts as irregular dies and moulds.

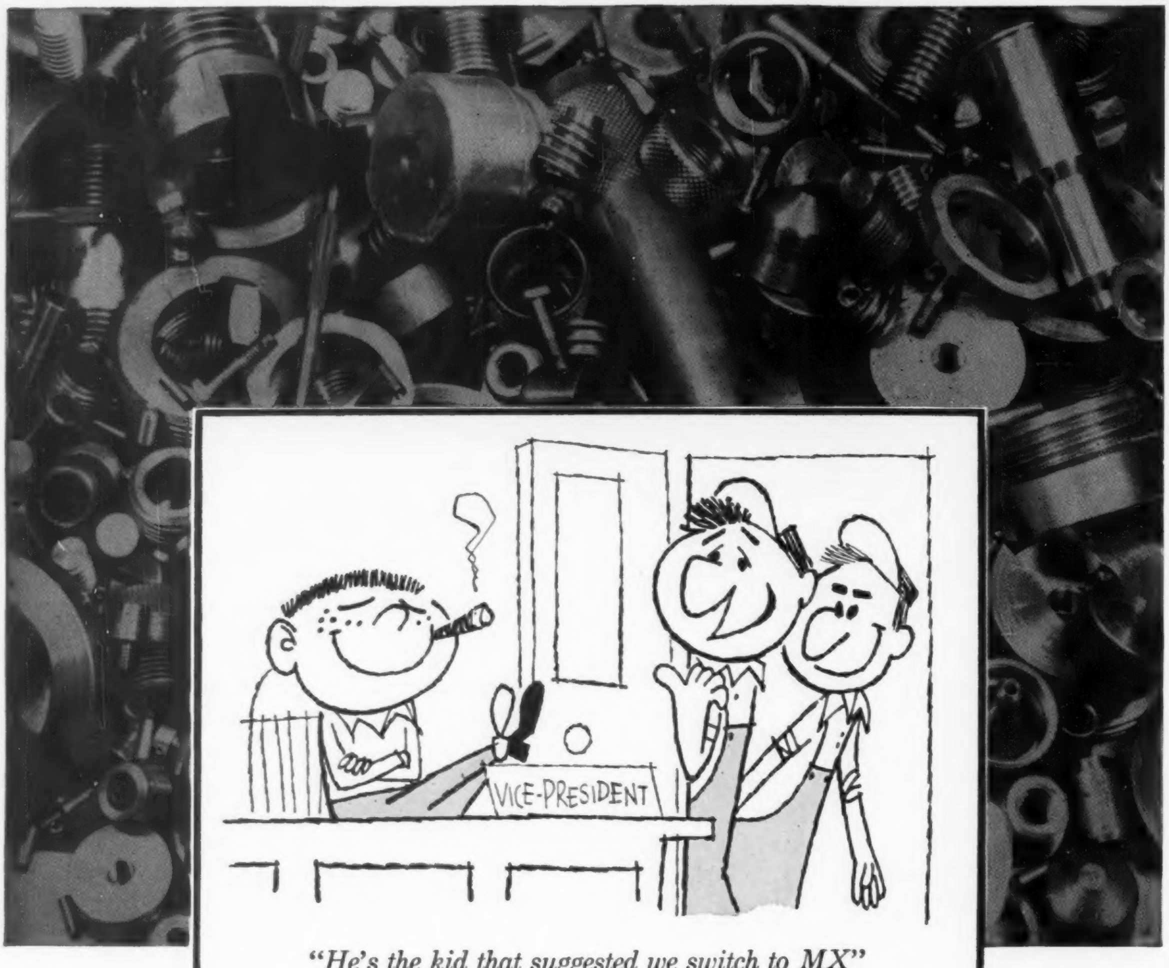
All these features have been tried and proved in day-to-day service in literally thousands of shops, large and small, because the "BRIDGEPORT" is within the reach of any and all shops who know "value" and modernize accordingly . . . with "BRIDGEPORTS."

Your nearest dealer will gladly furnish full information . . . or contact us direct.

Bridgeport MACHINES, INC.
Bridgeport, Connecticut
Manufacturers of High Speed Milling Attachments and Turret Milling Machines

For more information fill in page number on Inquiry Card, on page 223





"He's the kid that suggested we switch to MX"

A switch to USS Free-Machining MX Steel can have some remarkable results. Your production rates will take a jump—increase up to 50% or more depending on the job . . . your tools will last longer, often twice as long . . . machine down time will be reduced . . . your parts will have cleaner, sharper finish . . . dimensional accuracy will be easier to maintain . . . you'll have fewer rejects.

And, because MX sells at the same price as regular screw stock grades, your production costs will be lower.

Hundreds of progressive shops that have put this faster-cutting screw stock to work have proved this to be true. Based on the cost reductions they report, which average between 10 and 15% and have sometimes run as high as 42%, we feel confident that MX will cut the cost of any part you now machine from regular screw stock. The more machine work required, the greater your savings will be.

USS Free-Machining MX Steel has been successfully machined at speeds up to 350 SFM. It is produced in all the popular screw stock sizes and is available in both Bessemer and Open Hearth grades. You can buy it in cold-finished form from your regular supplier, either as "MX" or under his own identifying trade name. In hot-rolled form, MX is available through our nearest sales office. Why not give it a try?

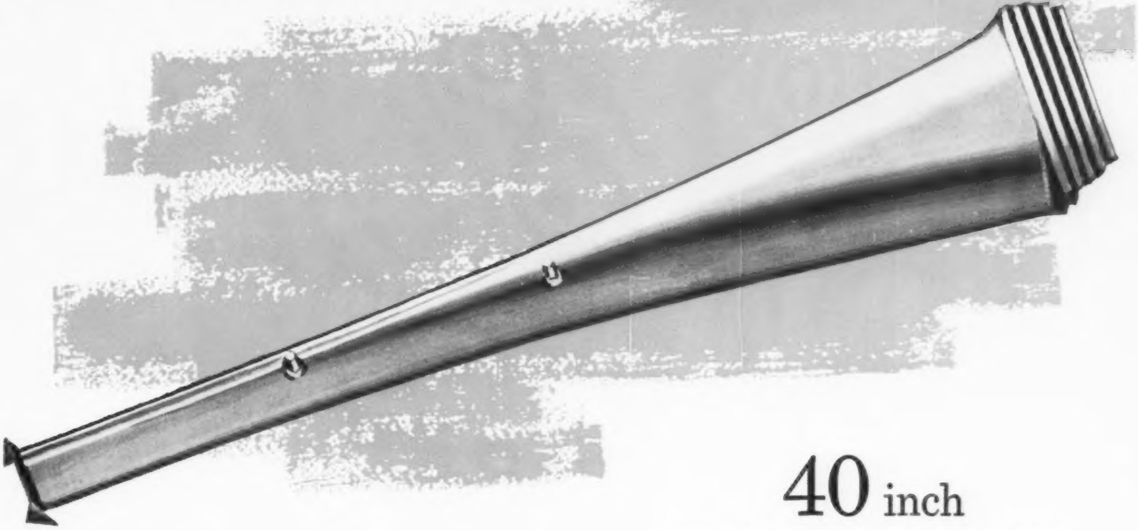
UNITED STATES STEEL CORPORATION, PITTSBURGH
AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION
WAREHOUSE DISTRIBUTORS, COAST-TO-COAST
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

More parts . . . better parts . . . at lower cost per part
***—when you do the job with free-machining* MX**

USS

UNITED STATES STEEL

HAYNES Alloys help solve the *tough* erosion problems



40 inch TURBINE BLADES Protected Against High-Velocity Erosion

. . . Two rows of 40-inch blades are shown on this double-flow, low-pressure steam turbine spindle. A 27-in. strip of HAYNES STELLITE alloy has been silver-soldered on each blade as protection against high-velocity erosion.

Blading at the cold end of modern condensing-type steam turbines is subjected to severe erosion. Rim speed of some turbines approaches that of a high speed bullet —even small water particles can cause rapid wear on most metal parts at these high velocities.

Yet when the leading edges of these blades are protected with shields of HAYNES STELLITE alloy, they remain in operation for as long as 19 years! This dramatic example of ruggedness is one of the reasons HAYNES cobalt-base alloys are used in many industries to solve abrasion and erosion problems.

For information on long-wearing and erosion resistant alloys, send for our Booklet. Write HAYNES STELLITE COMPANY, Division of Union Carbide Corporation, General Offices and Works, Kokomo, Indiana.

HAYNES
ALLOYS
HAYNES STELLITE COMPANY
Division of Union Carbide Corporation

UNION CARBIDE

For more information fill in page number on Inquiry Card, on page 223

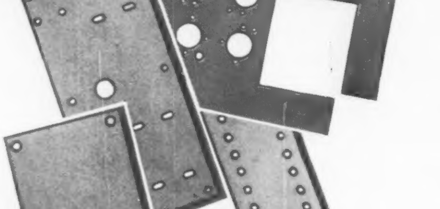
6 typical jobs—total cost of tools shown . . . $194.80! That's just the first of many cost-saving advantages of piercing short run jobs with a Wiedemann Turret Punch Press.

Hundreds of Wiedemann users report 60% to 90% direct savings in production of chassis, panels, side rails, etc. —and engineering changes are reduced to a matter of minutes.

Wiedemann Turret Punch Presses require only one punch and die of a size . . . rounds, squares, louvers, groups, extrusions . . . from 0.093" dia. to 7" square and each is ready for use . . . larger openings and notches are produced easily with a series of "hits". Here is real low-cost tooling flexibility.

Why not prove to yourself how much more you could produce for *less* with a Wiedemann. We'll be glad to make a time study of your work. Just send prints and ask for Bulletin 201.

There's a Wiedemann for every short run piercing requirement.

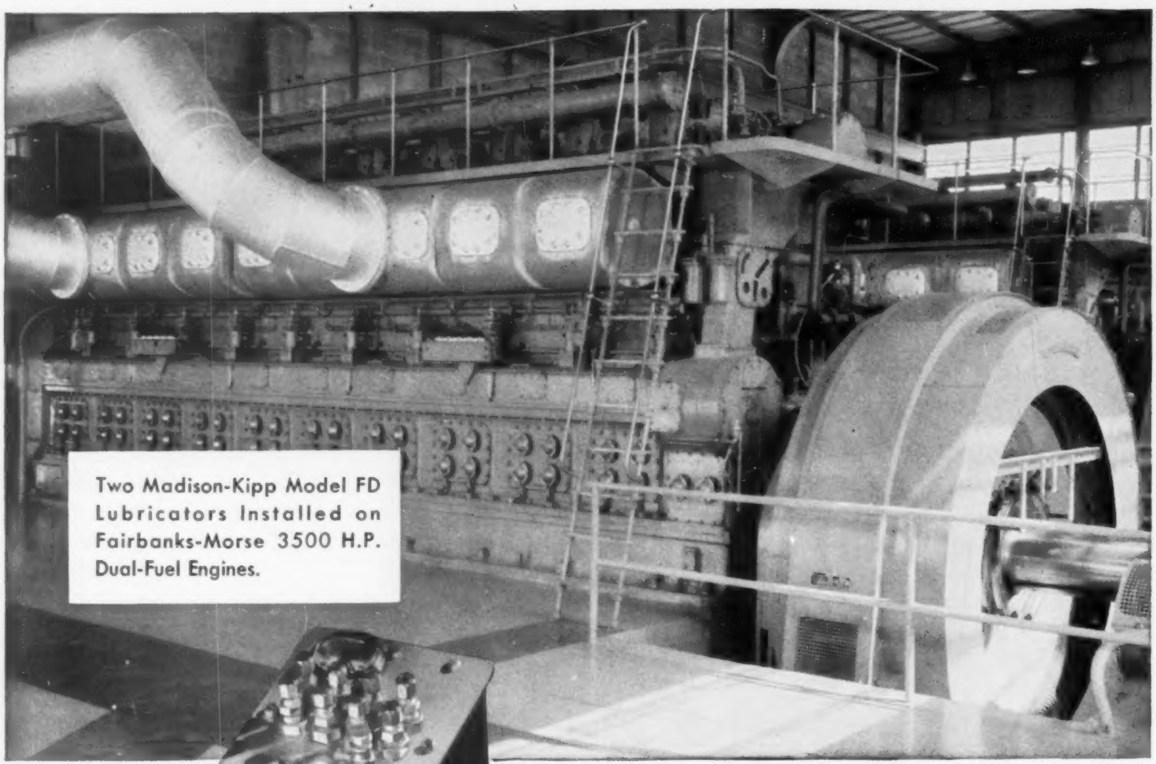


RA-41P Wiedemann
15-ton capacity
28" throat depth
Other presses from 4 to 150 tons

WIEDEMANN MACHINE COMPANY

4205 Wissahickon Ave. • Philadelphia 32, Pa.

For more information fill in page number on Inquiry Card, on page 223



Machines of great performance use the most dependable oiling system ever developed

MADISON-KIPP

Fresh Oil

...by the measured drop, from a Madison-Kipp Lubricator is the most dependable method of lubrication ever developed. It is applied as original equipment on America's finest machine tools, work engines and compressors. You will definitely increase your production potential for years to come by specifying Madison-Kipp on all new machines you buy, where oil under pressure fed drop by drop can be installed. There are 6 models to meet almost every installation requirement.

kipp

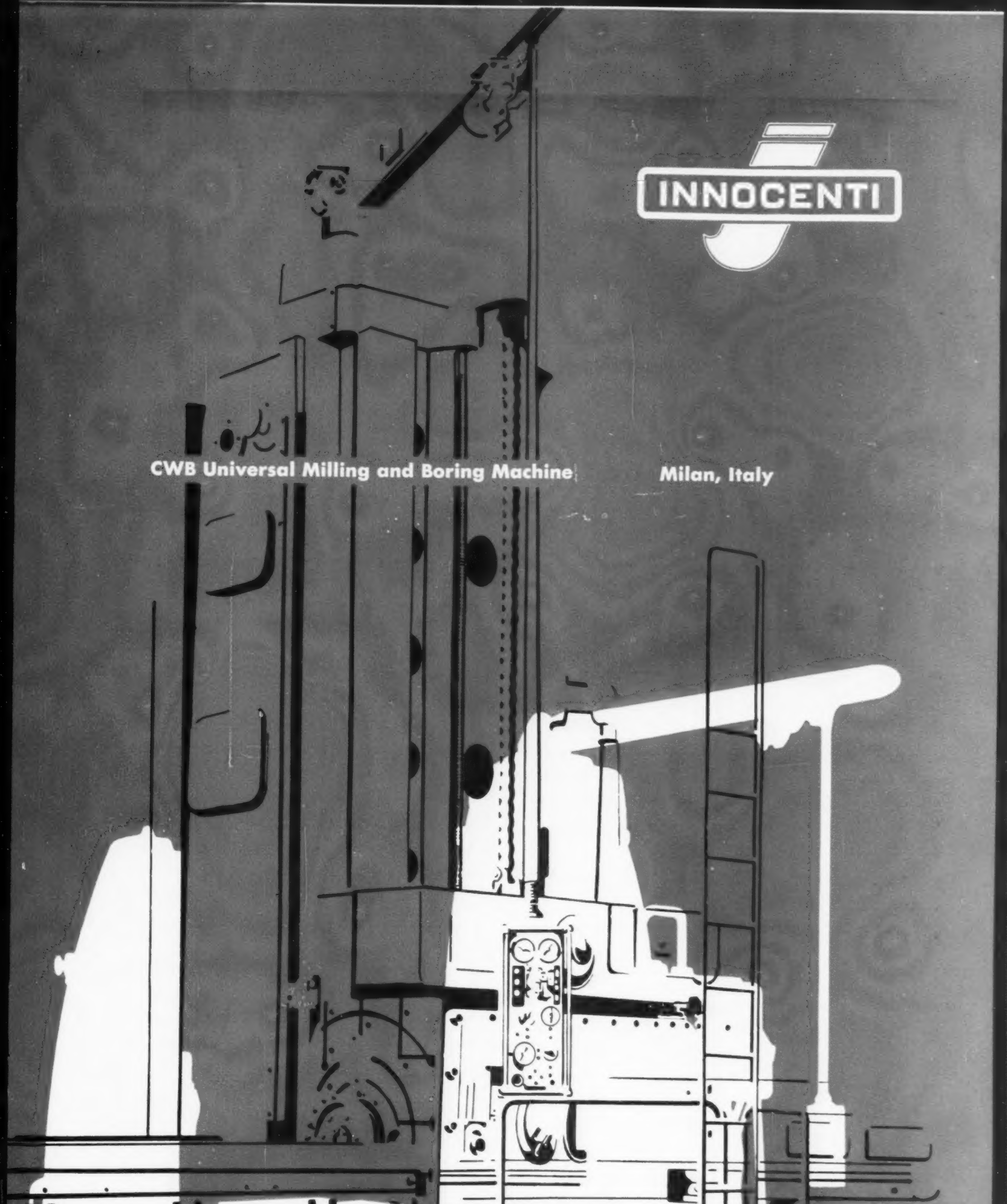
MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WIS., U.S.A.

Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

For more information fill in page number on Inquiry Card, on page 223

For more information fill in page number on Inquiry Card, on page 223

For more information fill in page number on Inquiry Card, on page 223


INNOCENTI
CWB Universal Milling and Boring Machine
Milan, Italy

UP TO 104-FT. DIAMETER RINGS for internal bracing of large elevated tanks — cold bent from heavy angles, leg-in, on "Buffalo" No. 3 Horizontal Bending Roll, to fractional-inch accuracy — by a leading fabricator. Machine uses no dies, only standard rolls.

FLATS BENT ON EDGE into spirals, which are then cut to circles and butt-welded — a high-production method used by major motor manufacturer for stator ring output. The "Buffalo" Vertical Bending Roll makes the job easy. Rolls are readily changed, adjusted to the shape and diameter.

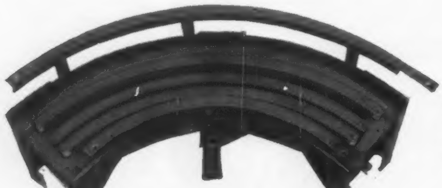
"BUFFALO" BENDING ROLLS ARE PAYING THEIR WAY IN DIE-LESS COLD BENDING

If you bend structurals into arcs, circles, spirals or segments in any quantities, there is no cheaper method than with a "Buffalo" Bending Roll. Bridge fabricators, steel mills, heavy equipment builders, aircraft and automotive users — metal working industries by the score — enjoy the ease and speed with which their "Buffalo" Bending Rolls turn out commercially accurate curves.

Steel warehouses have brought in profitable, new fabrication business by purchasing a Bending Roll. A mower manufacturer adapted his roll to apply the twist to his reel blades. Many firms use special rolls for 1001 highly specialized operations. All agree on the exclusive "Q" Factor* features of rigid, lasting construction, easy roll changes and diameter adjustments, simple operation requiring no highly skilled personnel — and no expensive die requirements.

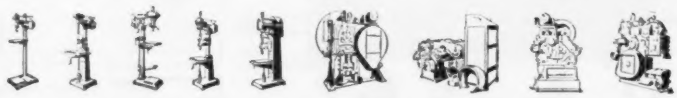
Write for Bulletin 352 and check details on the model to put your bending operations on a paying basis — or bring profitable new business into your plant.

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*



CONVEYOR MANUFACTURER gets fast output of curved sections involving angles and flats bent into arcs by "Buffalo" Bending Roll.

Any structural shape including tubes and pipes are easily and accurately bent to desired curves.



ESTABLISHED 1877 "Buffalo" MEMBER N.M.T.B.A.

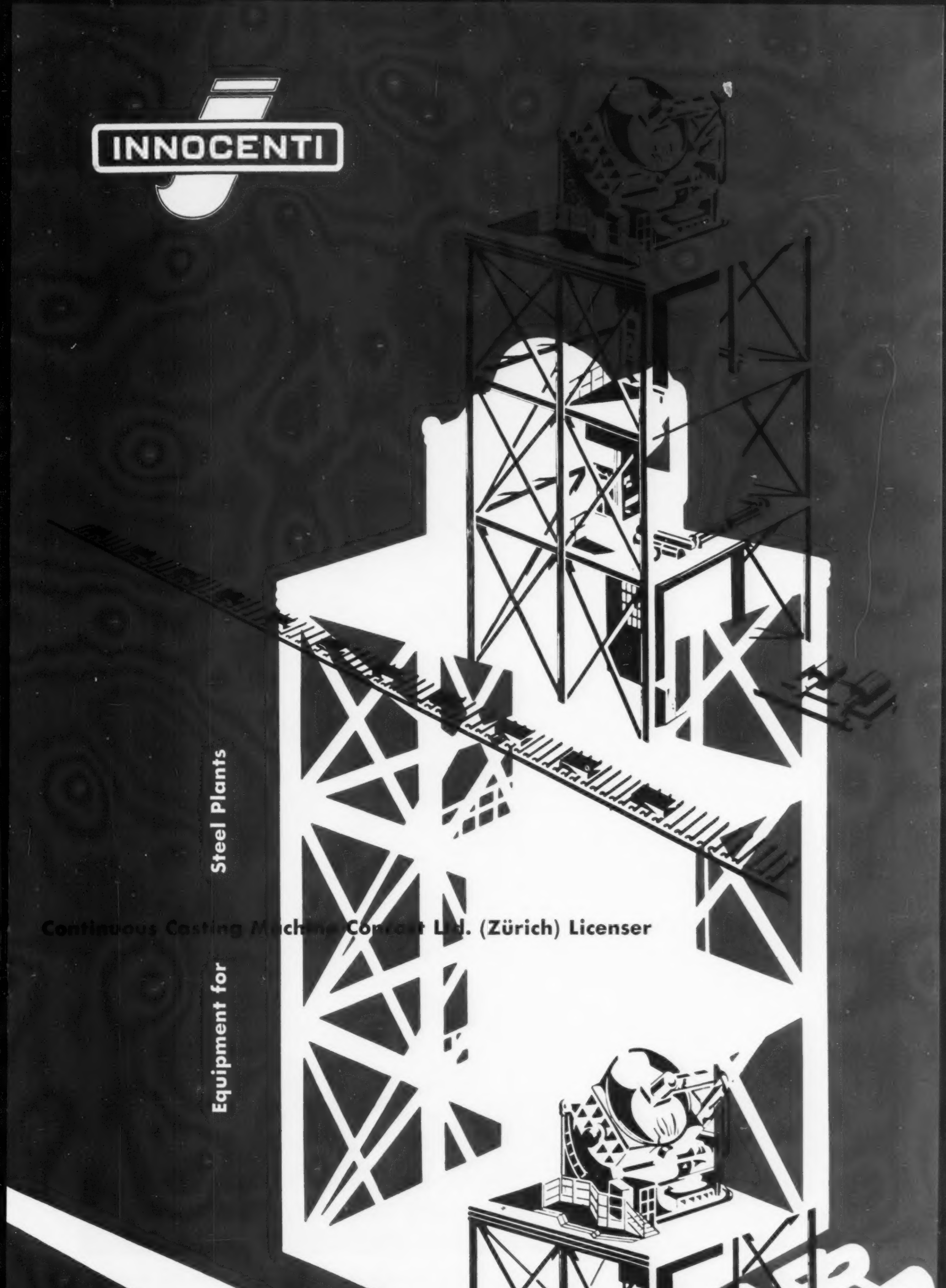
BUFFALO FORGE COMPANY

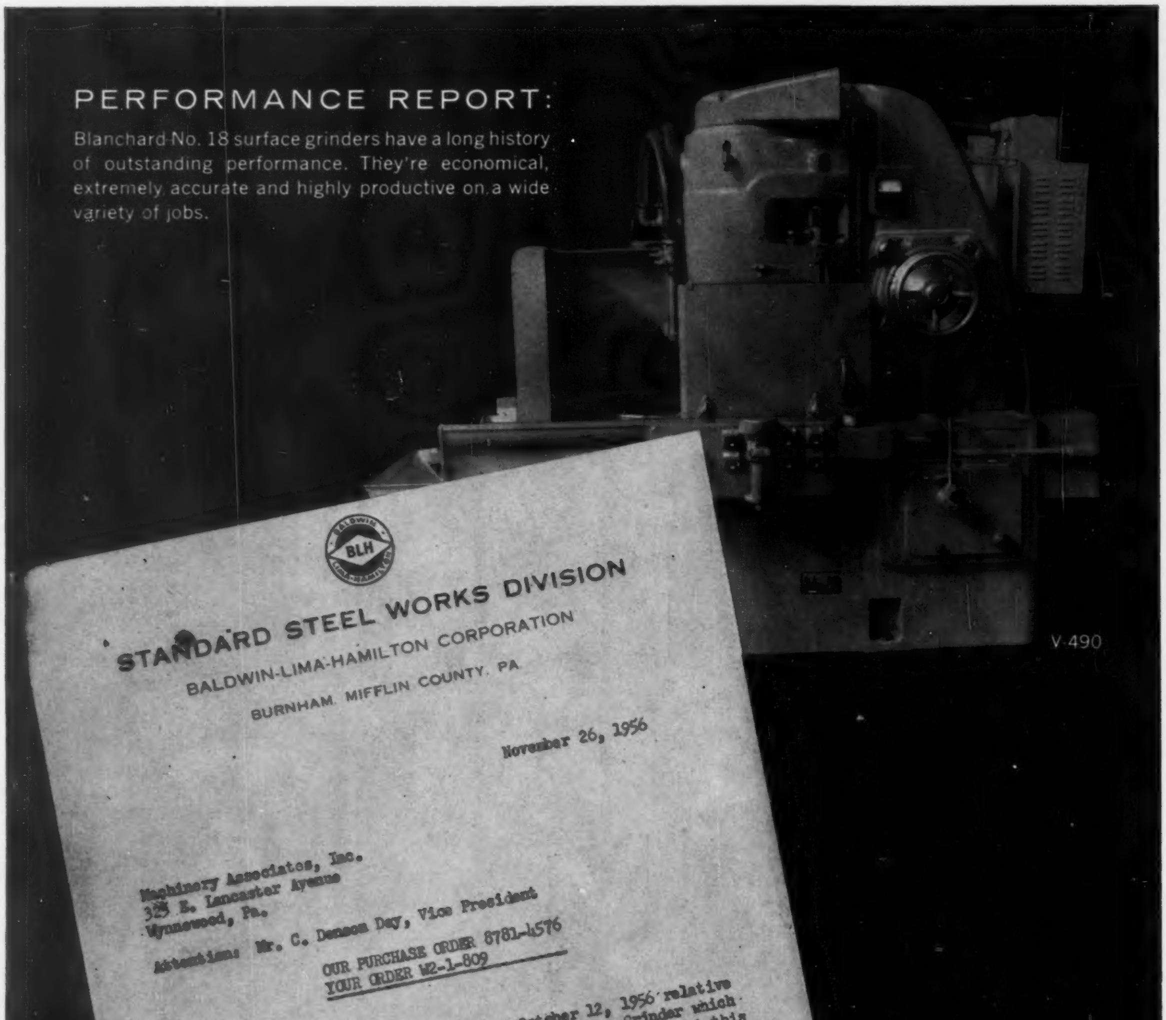
440 BROADWAY BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

For more information fill in page number on Inquiry Card, on page 223


INNOCENTI
Equipment for Steel Plants
Continuous Casting Machine Concast Ltd. (Zürich) Licenser


STANDARD STEEL WORKS DIVISION
BALDWIN-LIMA-HAMILTON CORPORATION
BURNHAM, MIFFLIN COUNTY, PA

November 26, 1956

Machinery Associates, Inc.
325 E. Lancaster Avenue
Wynnewood, Pa.

Attention: Mr. C. Denson Day, Vice President

OUR PURCHASE ORDER 8781-4576
YOUR ORDER W2-1-809

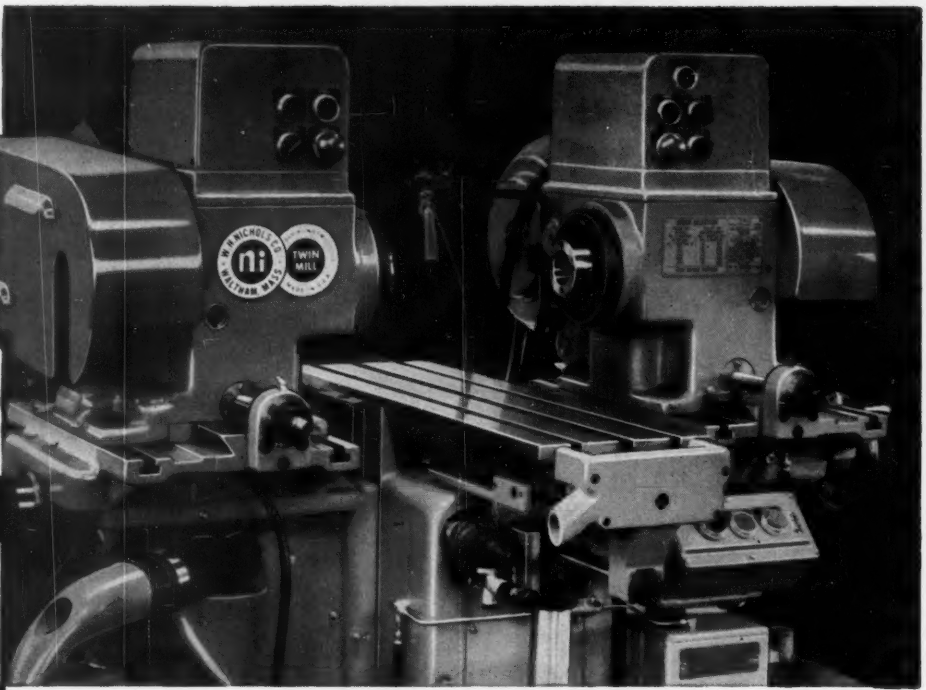
Gentlemen:

In response to your letter of October 12, 1956 relative to the No. 18 Blanchard High Power Vertical Surface Grinder which you furnished to us on the above order, I wish to advise that this machine has been entirely satisfactory. The machine was purchased primarily for grinding form and hollow bore cutters for our machine shops and the machine was installed in our Small Tool Department. We estimate that the savings which we have already experienced will allow us to amortize the machine in a period of approximately one year. Since the work load on cutters alone kept the machine busy only approximately one-third of the time, we have been able to do additional grinding which was formerly done on other machines and have been able to realize the same economies as we did on the grinding of the cutters.

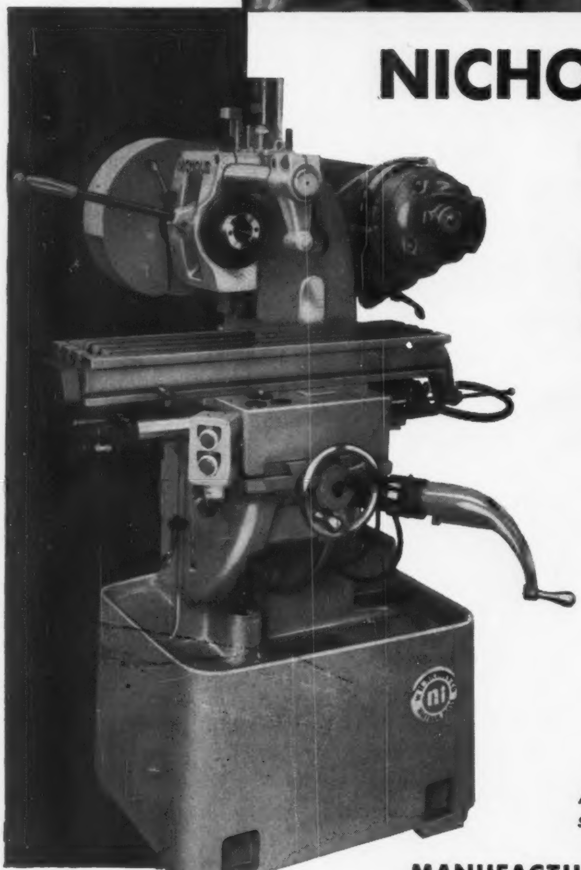
Yours very truly,

W. E. Shissler, Jr.
Chief Engineer

For more information fill in page number on Inquiry Card, on page 223



Twin Mill



Nichols 8SA
Semi-automatic

NICHOLS MILLERS . . .

Ideal Basic Machines for Automatic Production

NICHOLS MILLERS are versatile, work-devouring machine tools, unexcelled in accuracy and fine workmanship.

The TWIN MILL is practically TWO milling machines in ONE. Opposed Milling Heads have SIX-WAY adjustability for quick set-up and flexible approach to complex light milling operations. Push a button, and an automatic table cycle gives you TWO completed milling cuts. This unique duplex Miller is a cost-cutter without equal!

For high production precision milling where the double-barrelled approach of the TWIN MILL is not required, there are single spindle NICHOLS Semi-automatic Millers of varying work ranges. In addition to automatic table cycles, synchronized automatic down-feed of spindle head and automatic cross feeds are available.

NICHOLS MILLERS have a magnetic attraction for the Tool Engineer's ingenuity.

Write for literature and illustrations.

A NEW 16 mm. sound, color movie is available for free showing. May we reserve it for you?

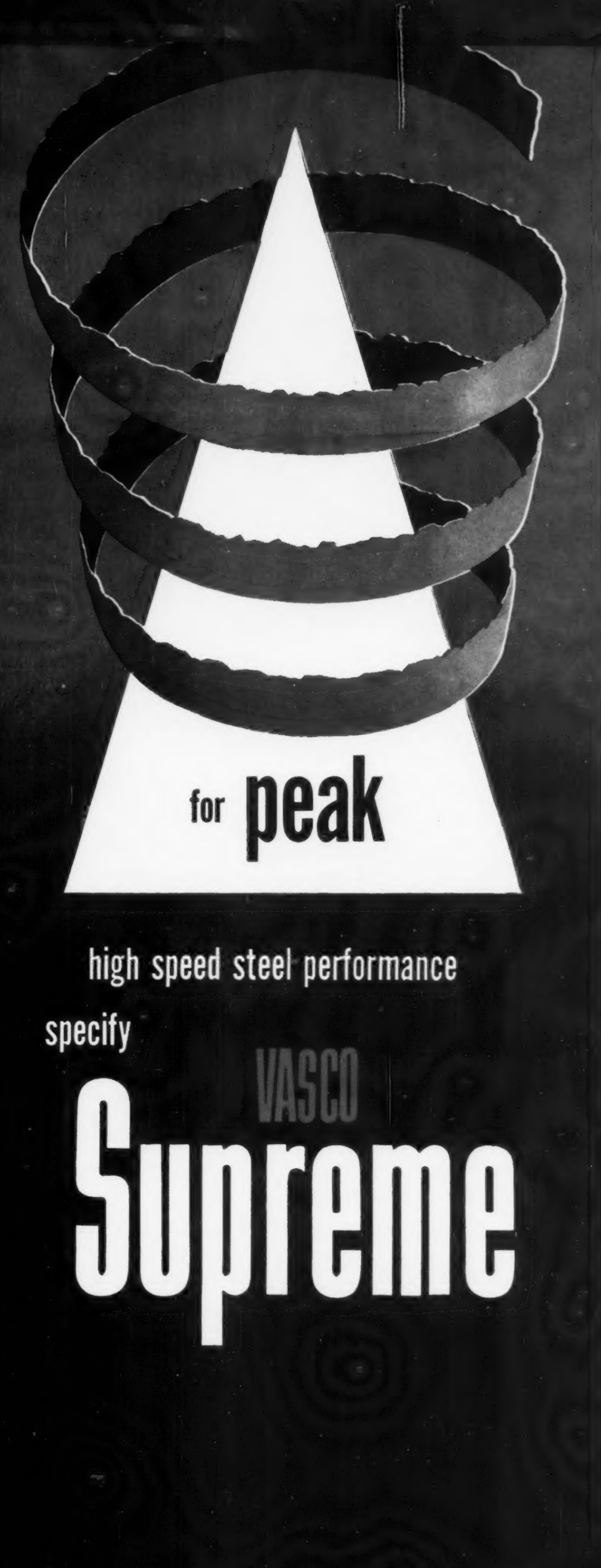
MANUFACTURED BY W. H. NICHOLS COMPANY

National Distributors **THE ROBERT E. MORRIS COMPANY**

REM SALES DIVISION

5002 FARMINGTON AVENUE • WEST HARTFORD 7, CONN.

For more information fill in page number on Inquiry Card, on page 223



TYPICAL REASONS-WHY . . .

turning

On B-1113 stock, cast alloy gave 500 pieces per grind. *Vasco Supreme* delivers 3500-4000 pieces—upping production 20%.

milling

Cast iron cams. Standard high speed steel formerly used gave 7 cams per grind—*Vasco Supreme* now cuts 135!

drilling

Glass fiber. Standard high speed steel on this material, 4-5 holes. *Vasco Supreme,* 1400 holes before sharpening.

form cutting

SAE 4340. Using 18-4-1 nitrided, customer got 380-400 pieces per grind. *Vasco Supreme* changed matters: 906-1230 pieces.

nibbling

Steel plate. Large-diameter rings, 3/16" thick, are nibbled by tool and die cutting inside and outside of circle. *Vasco Supreme* gives twice the production per grind over competitive grade.

compacting

Electrolytic iron powder. *Vasco Supreme* compacting punch produced 4,000,000 parts (gears) during run.

blanking

High silicon sheet. On indexing type lamination die, previous high-carbon, high-chrome steel made 3000 hits . . . *Vasco Supreme* ran 65,000.

scalping

Hard drawn brass and copper. Dies of *Vasco Supreme* provide 300 per cent longer life than 18-4-1 steel.

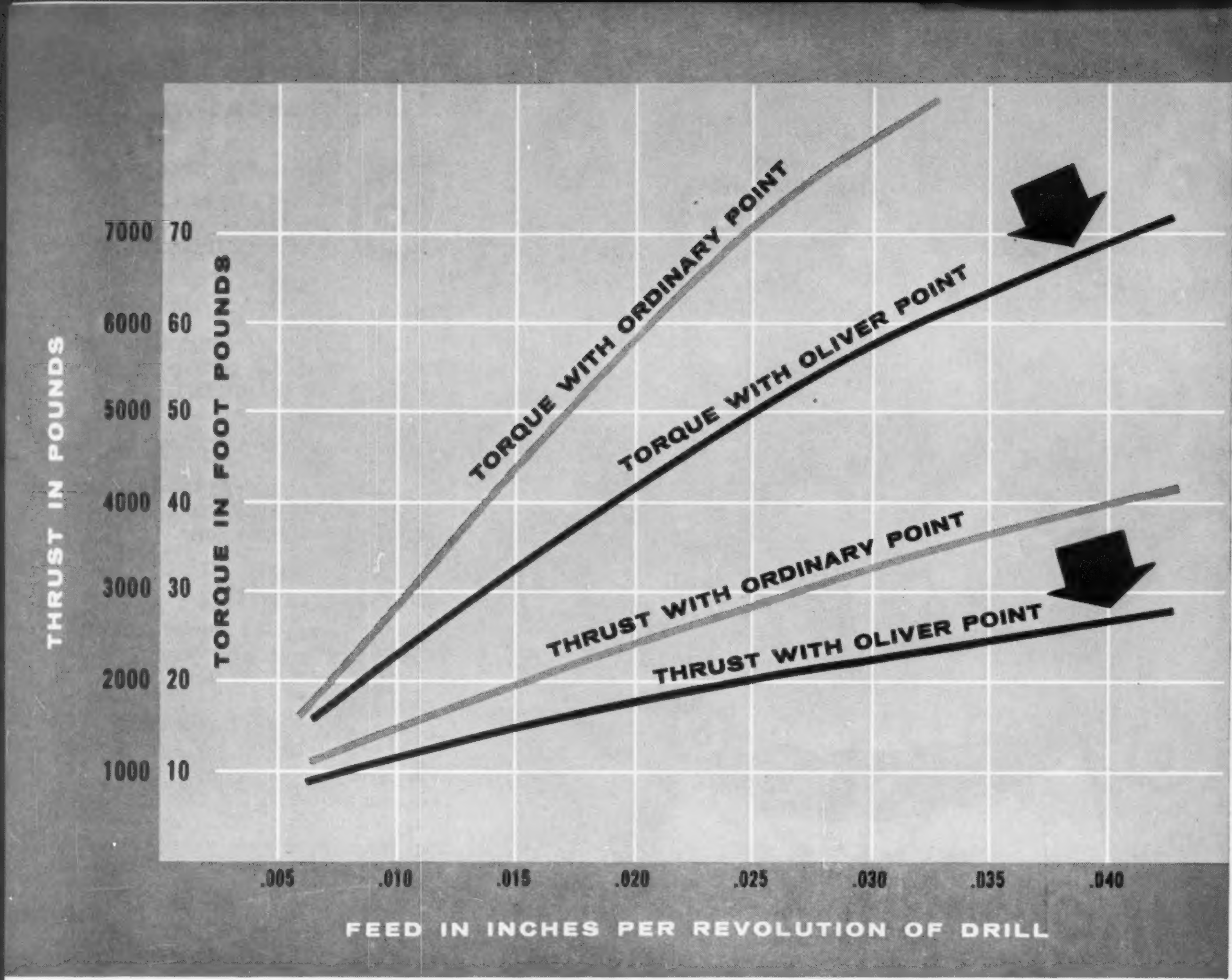
and for your own particular application

Give first thought to Vasco Supreme. Have a metallurgically-trained Vanadium-Alloys sales engineer check with you on the benefits you can expect, and let Supreme deliver!

VANADIUM-ALLOYS STEEL CO.

LATROBE, PENNSYLVANIA

SUBSIDIARIES: Colonial Steel Co. • Anchor Drawn Steel Co. • Pittsburgh Tool Steel Wire Co. • Vanadium-Alloys Steel Canada Limited • Vanadium-Alloys Steel Societa Italiana Per Azioni • EUROPEAN ASSOCIATES: Societe Commentryenne Des Aciers Fins Vanadium-Alloys (France) • Nazionale Cogne Societa Italiana (Italy)

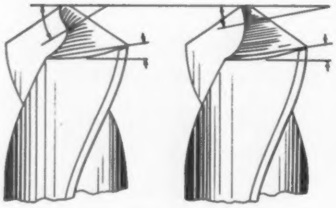


CURVES SHOWING EFFECT OF VARYING FEEDS, TORQUE and THRUST—1″ DRILL IN C. R. S.

OLIVER DRILL POINTER

PROOF!

OLIVER helps you get more holes per grind!

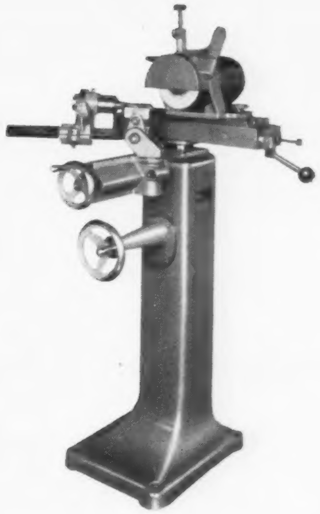


The drill point on the right is one as ordinarily ground. On the left is an exaggerated view of an Oliver drill point. Note that the clearance angle on the point increases very rapidly as the drill web is approached.

Substantially less torque—much less thrust!

The above graph is the result of tests run by the research department of an eastern engineering school. It is evidence that Oliver can help you get more and better holes per grind.

Oliver's sharpening principle is to grind the drill point so that increased clearance is obtained at the center of the drill. The cut is balanced with each lip doing its equal share and the theoretically perfect point permits easier penetration. A drill sharpened this way has the stamina to deliver more holes before resharpening. Less feeding pressure means savings on drilling machine repairs, power and transmission costs and the drills themselves.



OLIVER

510 DRILL POINTER

Operation is semi automatic . . . covers the entire range of drill sizes from $\frac{1}{4}''$ to $3''$ diameters . . . grinds two-, three- and four-flute drills and all point angles from 82° to 160° included. The form of the point is controlled by a master cam which may be varied to produce the proper clearance for the material being drilled.

OLIVER

21 DRILL POINTER

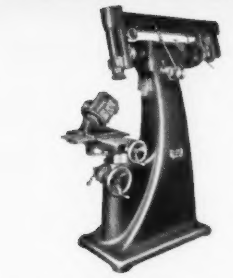
. . . a precision machine for small drills and built to machine tool standards. Drills are located in a jig before grinding for positive set-up. A definite setting produces the desired grind each time—accurately and uniformly. The machine may be mounted on a bench or a pedestal.

OLIVER

DRILL POINT THINNER

. . . designed for conventional point thinning and other work such as deep hole drill thinning, notching, chip breaking, clearing out flute and many other thinning operations. The machine is completely universal, easy to set up and operate. It is a natural companion to the 510 drill pointer.

More OLIVER *of* ADRIAN *Tool Grinding Equipment*

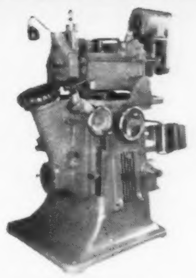


"ACE" TOOL-CUTTER GRINDER

Universal—grinds wide range of milling cutters and other cutting tools. Especially suited to grinding tungsten carbide.

DIE MAKING MACHINE

Built to produce dies, gages, cams, templates, stripper plates, etc. at greatly reduced costs. Five designs in two types.



FACE MILL GRINDER

The only completely automatic grinder on the market. A machine tool designed for accurate grinding.

TEMPLATE TOOL BIT GRINDER

Controlled form grinding for high speed, stellite and tungsten carbide single point tools.

Just check the coupon for literature on the OLIVER of ADRIAN machine you are interested in. Send it today to . . .

OLIVER of ADRIAN

OLIVER INSTRUMENT COMPANY

1410 E. Maumee St. • Adrian, Michigan

- ☐ Drill Pointer
- ☐ Face Mill Grinder
- ☐ "Ace" Universal Tool and Cutter Grinder
- ☐ Die Making Machine
- ☐ Drill Point Thinner
- ☐ Template Tool Bit Grinder

NAME__________

COMPANY__________

STREET__________

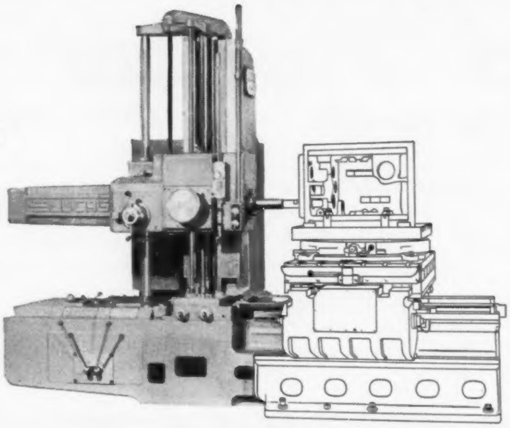
CITY______ ZONE______ STATE______

Select a Lucas

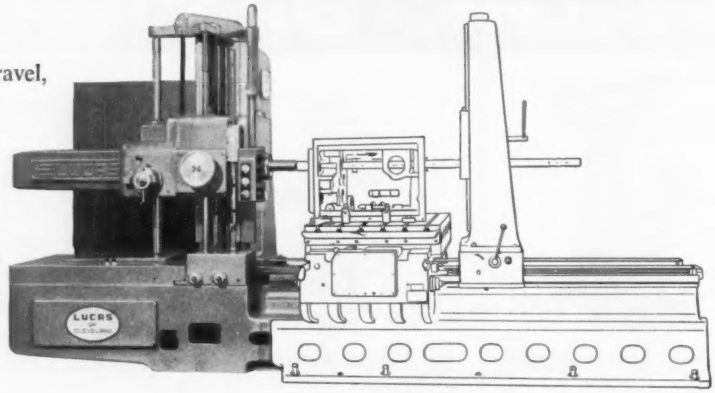
- **for accurate spacing**
- **for precision boring**
- **for heavy milling**

Your choice of controls—

STANDARD LEVER CONTROLS
available for use with both short bed or backrest models.



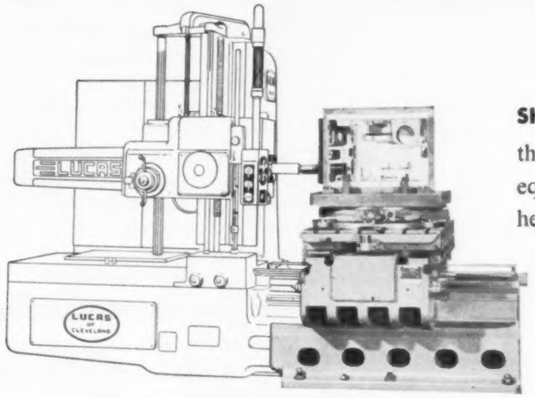
FULL PENDANT CONTROL
of feeds, speeds and directional travel, optional on any Lucas.



Whether you do line or stub boring, whether you prefer lever or automatic pendant control, you get the basic advantages of automatic power positioning and 4-way beds. Whichever model you select you get the benefit of continuing design improvement, backed by 57 years of specialization and leadership in this field *plus* the full resources of The New Britain Machine Company.

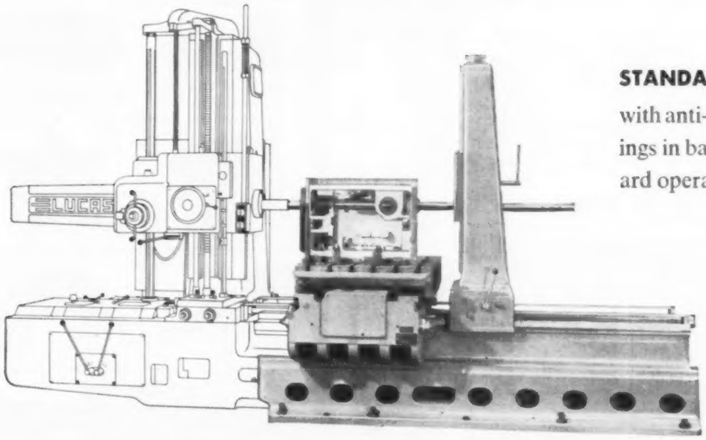
in production
in the tool room
in experimental work
in engineering research
in maintenance applications
or several, in combination

your choice of beds



SHORT BED MODELS

the most compact and economical equipment for precision stub boring, heavy milling and horizontal drilling.



STANDARD BED WITH BACKREST

with anti-friction bearing mounted bushings in backrest block, handles all standard operations including line boring.

LUCAS OF CLEVELAND

LUCAS MACHINE DIVISION
The New Britain Machine Company
Cleveland, Ohio

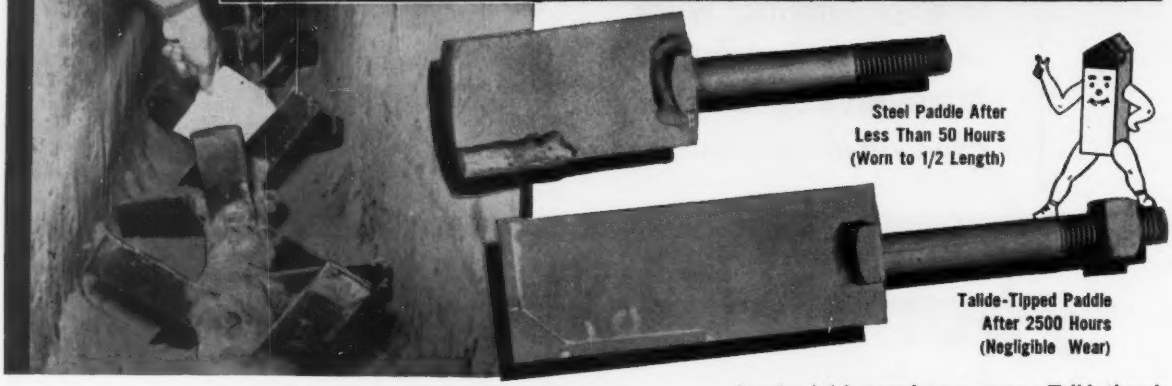
OTHER NEW BRITAIN MACHINE TOOLS DIVISIONS

New Britain-Gridley Machine Division
New Britain, Connecticut

Hoern & Dilts Division
Saginaw, Michigan

For more information fill in page number on Inquiry Card, on page 223

Talide Paddles Last 50 Times Longer!



Leading brick manufacturer reports Talide-tipped pug mill paddles have outlasted 50 sets of hard-faced steel paddles to date—and are still in use. Operation involves mixing abrasive ceramic, clay and brick compositions.

TALIDE METAL is saving industry millions of dollars annually by wear-proofing vital parts on machine tools, presses, pumps, compressors and other types of processing equipment used in the steel, oil, chemical, plastic, auto, rubber, textile, glass, ceramic, mining and metalworking industry.

HARDEST MAN-MADE METAL!

TALIDE METAL, a tungsten carbide of superior quality, is harder, stronger, and more resistant to abrasion than any other metal. Properly applied, it gives superior service on applications where wear, heat, strain, and shock are destructive to other metals.

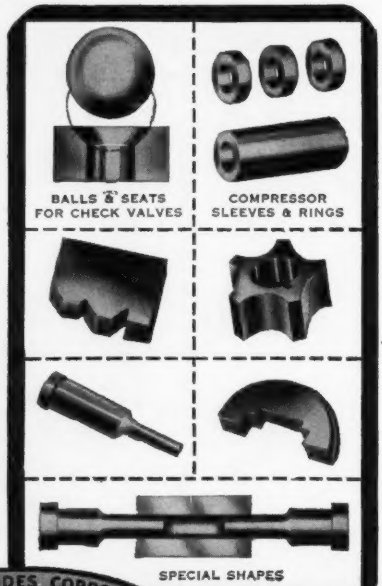
- **ABRASION RESISTANCE**— Up to 100 times that of steel.
- **COMPRESSIVE STRENGTH**— Higher than all melted, cast or forged metals and alloys.
- **RESISTANCE TO DEFORMATION**— 2 to 3 times greater than steel.
- **HEAT RESISTANCE**— Resists oxidation and thermal shock up to 1500° F.
- **THERMAL EXPANSION**— Less than half the rate of steel, "creep" is negligible.
- **FRICTIONAL RESISTANCE**— Lower than steel, non-galling, "slippery" properties higher.

ALL TALIDE METAL grades are made in latest type vacuum electric furnaces by precision methods under rigid control. A wide variety of shapes and sizes can be supplied—up to 25" in diameter, 100" in length, and 5000 pounds by weight. Parts can be supplied to any grit finish required down to one micro-inch. The physical properties of the most commonly used grades are listed below. Other grades are available for specialized applications.

PHYSICAL PROPERTIES OF TALIDE METAL (P. S. I.)

Application	Operation	Talide Grade	Rockwell "A" Hardness	Specific Gravity (Density)	Transverse Rupture Strength	Compressive Strength	Co-Efficient of Thermal Expansion	Modulus of Elasticity (Deflection)
WEAR SURFACE	No Shock	C-91	91.8	14.90	235,000	710,000	3.00x10-6	91,000,000
	Light Shock	C-99	91.0	14.75	265,000	670,000	3.65x10-6	84,000,000
	Medium Shock	C-88	89.5	14.55	295,000	635,000	4.00x10-6	80,000,000
IMPACT	Light	C-85	88.4	14.25	315,000	600,000	3.75x10-6	77,000,000
	Medium	C-80	87.0	13.85	335,000	550,000	4.50x10-6	74,000,000
	Heavy	C-75	85.0	13.15	355,000	500,000	5.00x10-6	70,000,000

Note: Hardness values may vary plus or minus .2 to .3 on individual lots.



Send for new 76-page catalog 56-G or ask for sales engineer to call.

Metal Carbides Corporation
Youngstown 12, Ohio

METAL CARBIDES CORPORATION
MC
TALIDE®
YOUNGSTOWN 12, OHIO

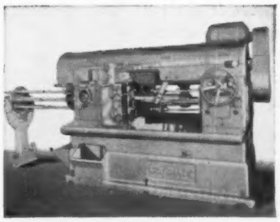
HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

First with NEW "Automatic" Service

Cone was the first builder of multiple spindle automatics to provide machine users with an experimental service in the application of carbide tools.

This service is a practical means of determining the possibilities of carbide tools for production men without loss or interference with their regular production schedules.

A pamphlet "FOUR STEPS WITH CONE" describes this service. Send for your free copy.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U. S. A.

For more information fill in page number on Inquiry Card, on page 223

Here's real news—the first major improvement in hydraulic surface grinding in the past 20 years.

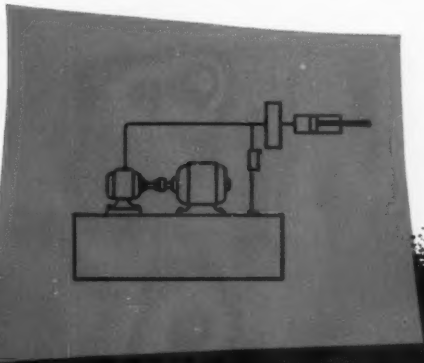
Heat, generated by continuous production grinding and constant hydraulic system operation, has long been a serious problem. General machine distortion, caused by extremes of temperature on top and bottom surfaces, has made close tolerances impossible to achieve. Excessive heat is destructive to the hydraulic system itself. Various and costly corrective measures have failed to solve this heat problem. Oil cooling and insulating devices have been only partially successful.

Now, the new Thompson Hydra-Cool system eliminates hydraulic heat *at its source*—with the new Thompsons, you hold your tolerances, no matter how close they may be or how long the run! Exhaustive tests have convincingly proved that, even after 24 hours of continuous operation, temperatures in the new Thompson Hydra-Cool hydraulic system have risen *only 3 degrees above ambient temperatures.*

To you, the new Thompson Hydra-Cool hydraulic system assures greater precision, less scrap loss, more trouble-free hydraulic operation—actual savings in dollars and cents! The new Hydra-Cool hydraulic system is available on all types of Thompson machines 40 inches and above in work length AT NO EXTRA CHARGE.

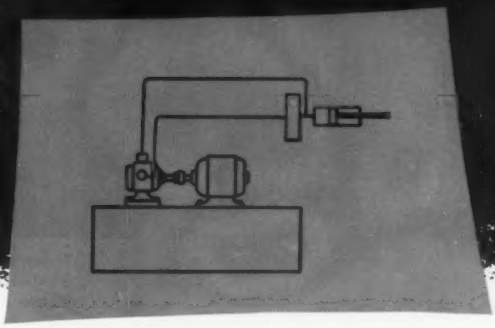
Again... THOMPSON LEADS IN SURFACE GRINDING ENGINEERING

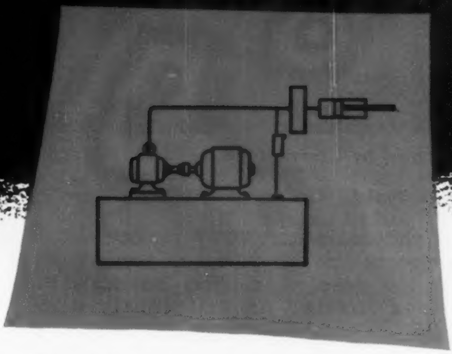
grinders eliminate hydraulic system heat



System No. 1—Constant volume hydraulic pump systems provide a continuous flow of oil for table reciprocation with pressures controlled by a relief valve set for greatest work need. Total pump volume circulates throughout the system continuously, generating heat even when the table is at rest. Oil coolers are a necessity on production work involving precision grinding.

WHICH TYPE OF SYSTEM WOULD YOU RECOMMEND?





System No. 2—Variable volume hydraulic systems regulate oil flow to the work requirement at adjustable rates, reducing oil flow through the system to only that volume necessary for each job. This limiting of flow through the system is an improvement over constant delivery systems but pressures within the system are still controlled by preset relief valve settings so that near constant pressures are maintained throughout the run. Oil coolers are also necessary for these systems.

The Thompson Hydra-Cool System*—New, pressure-compensating, variable delivery systems on new Thompson grinders control the rate of table movement and operating pressures automatically through a single hand lever control. As operator adjusts rate of table movement for the initial phase of each job, pressures within the system adjust automatically for the exact requirement to move the table smoothly and a constant speed. This modern pressure servo type system keeps HP input to the minimum. When the table is stopped, the pump ceases to pump oil. Hydraulic system heat remains at levels close to the ambient temperatures of the room. Distortion of the grinder bed is completely eliminated . . . at the source, without accessory cooling systems or expensive insulation methods. YOU GET THESE ADDED ADVANTAGES AT NO EXTRA COST.

*PATENT APPLIED FOR

MAIL THIS COUPON TODAY!

The Thompson Grinder Company ● Springfield, Ohio, U. S. A.

Please send me your free booklet giving important facts on the new Thompson Hydra-Cool Hydraulic System.

NAME .... TITLE ....

COMPANY ....

ADDRESS ....

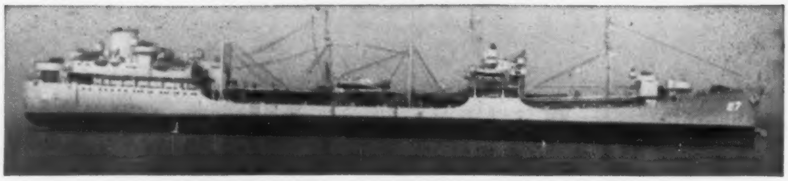
CITY .... ZONE .... STATE ....

Thompson

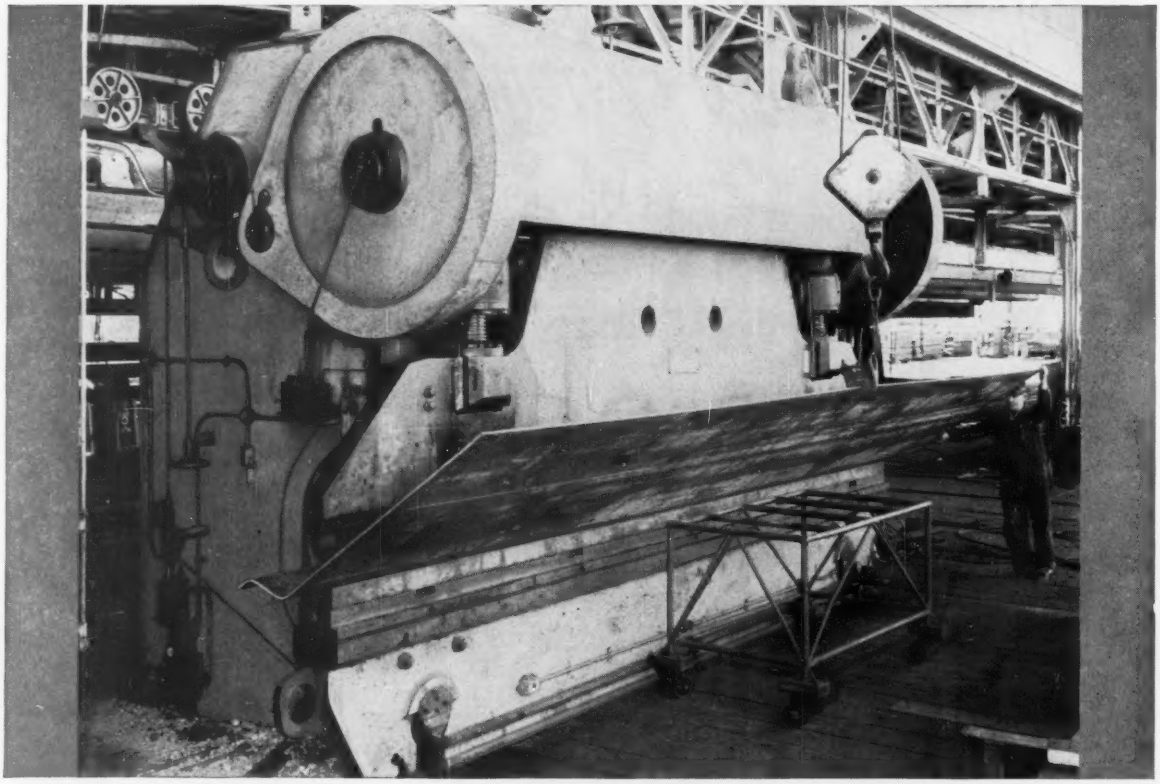
SURFACE GRINDERS

For more information fill in page number on Inquiry Card, on page 223

U.S.S. KASKASKIA is typical of many ships which have had extensive bulkhead and other repairs at Moore Dry Dock Company.
Official U. S. Navy Photograph



Moore Dry Dock SPEEDS MARINE REPAIRS

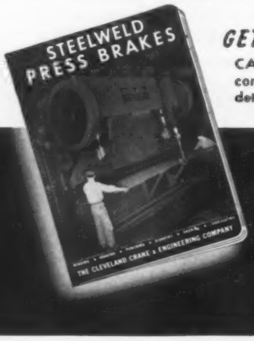


Fluted bulkhead plate being formed by Steelweld bending press in plate shop of Moore Dry Dock Company for bulkhead renewal job on U.S.S. "KASKASKIA" (A027). Size of plate: length 26', width 6', thickness ½".

Long a leading West Coast ship builder and marine repairs concern, the Moore Dry Dock Company, Oakland, California, has found a large Steelweld Bending Press to be a great asset in speeding the forming of heavy plate.

Ship repair, which constitutes an important part of the company's business, often requires replacement of large sections, such as bulkheads. This necessitates the forming of plates to various shapes to accurately replace those removed. Because of the power of their Steelweld and the ease of making adjustments, this work is carried on efficiently and satisfactorily.

The entire line of Steelwelds has an enviable reputation for continuous high-production performance. We urge you to get the facts on their many outstanding features.



GET THIS BOOK!
CATALOG No. 2010 gives construction and engineering details. Profusely illustrated.

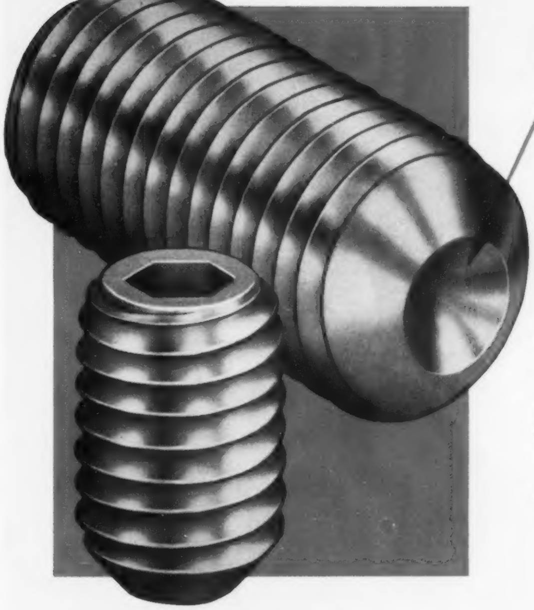
THE CLEVELAND CRANE & ENGINEERING CO.

5462 EAST 281st STREET • WICKLIFFE, OHIO

STEELWELD

PRESS BRAKES

BRAKING • FORMING • BLANKING • DRAWING • CORRUGATING • PUNCHING



ALLENPOINT will give you a bulldog grip at no premium in price!

Allen's scientific redesign of the cup diameter on set screws gives greatly increased resistance to *withdrawal* torque. You can count on Allenpoint Set Screws to stay tighter longer, under heavy strain and vibrations. This dependable premium performance of Allenpoints is yours to use without increasing the cost of manufacturing your products.

Uniform Class 3A Threads

Allenpoints' smooth, uniform threads prevent off-lead conditions like Fig. 1. With Allenpoints, you have full, even contact between the engaging flanks of the threaded members (Fig. 2) –and a tight friction lock over the entire length of the Allenpoint Set Screw.

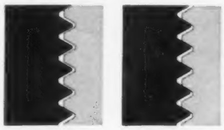
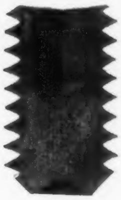


Fig. 1 Fig. 2

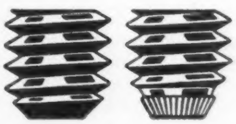
Strong, clean, deep sockets allow full wrenching leverage



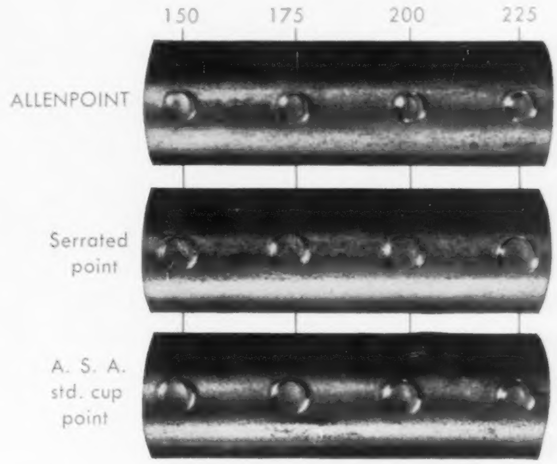
Sockets of Allenpoint Set Screws are cold forged to produce a deeper, smoother socket. No broach chips to interfere with proper seating of the key. This "pressur-forming" preserves the long steel fibers throughout the length of the screw–stronger walls allow maximum tightening torque.

One more full thread on ALLENPOINTS!

Allenpoint Set Screws have one more full thread than serrated point set screws. That means more holding power–especially important when you're using short lengths.



ALLENPOINT's performance compared for you



These actual-size, unretouched photographs show the cup pattern made by Allenpoints, serrated points, and A.S.A. standard cup point set screws in a 3/4″ steel shaft. At each degree of tightening force, Allenpoints make a full circle pattern, penetrating deeper for greater holding power.

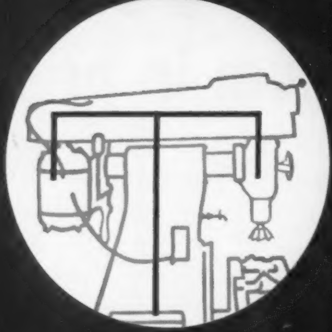
We'll be glad to send you more information and samples of Allenpoint Set Screws and other Allen Socket Screw products.

Stocked and sold by leading industrial distributors everywhere

ALLEN MANUFACTURING COMPANY
Hartford 2, Connecticut, U. S. A.

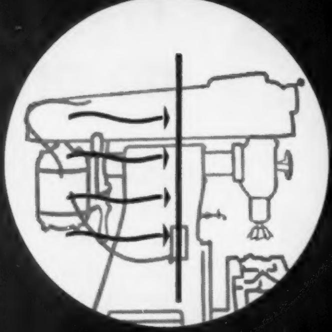
For more Information fill in page number on Inquiry Card, on page 223

BALANCED RIGIDITY



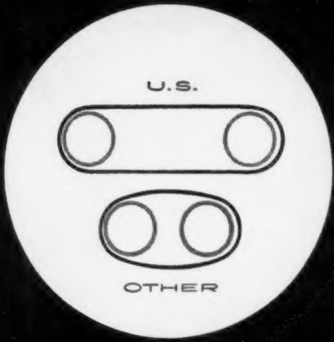
Motor mounted behind column balances weight of head, minimizes deflection.

ISOLATION OF MOTOR VIBRATION



Column acts as baffle, keeping motor vibration away from head.

MORE EFFICIENT POWER TRANSMISSION



Wide belt spacing permits use of B-section V-belt, more wrap-around on pulleys.

mill more accurately with the

U.S.Vertical MILLING MACHINE

The *exclusive* motor mount design of the U. S. Vertical provides balance, rigidity and greater milling ACCURACY! And, check these ADDED features — all designed to aid in close tolerance work.

- Machine weighs 2000 lbs.
- Massive knee, saddle and table
- Extra wide bearing surfaces
- Tested and CERTIFIED ten ways
- Major castings are internally ribbed, normalized and stress relieved.
- Dovetails are deep and hand scraped
- Extra quill, knee, saddle and table travel

Write for your FREE copy of new U. S. Vertical Milling Machine Bulletin.

Builders of Milling Machines only

U★S★Burke

MACHINE TOOL DIVISION

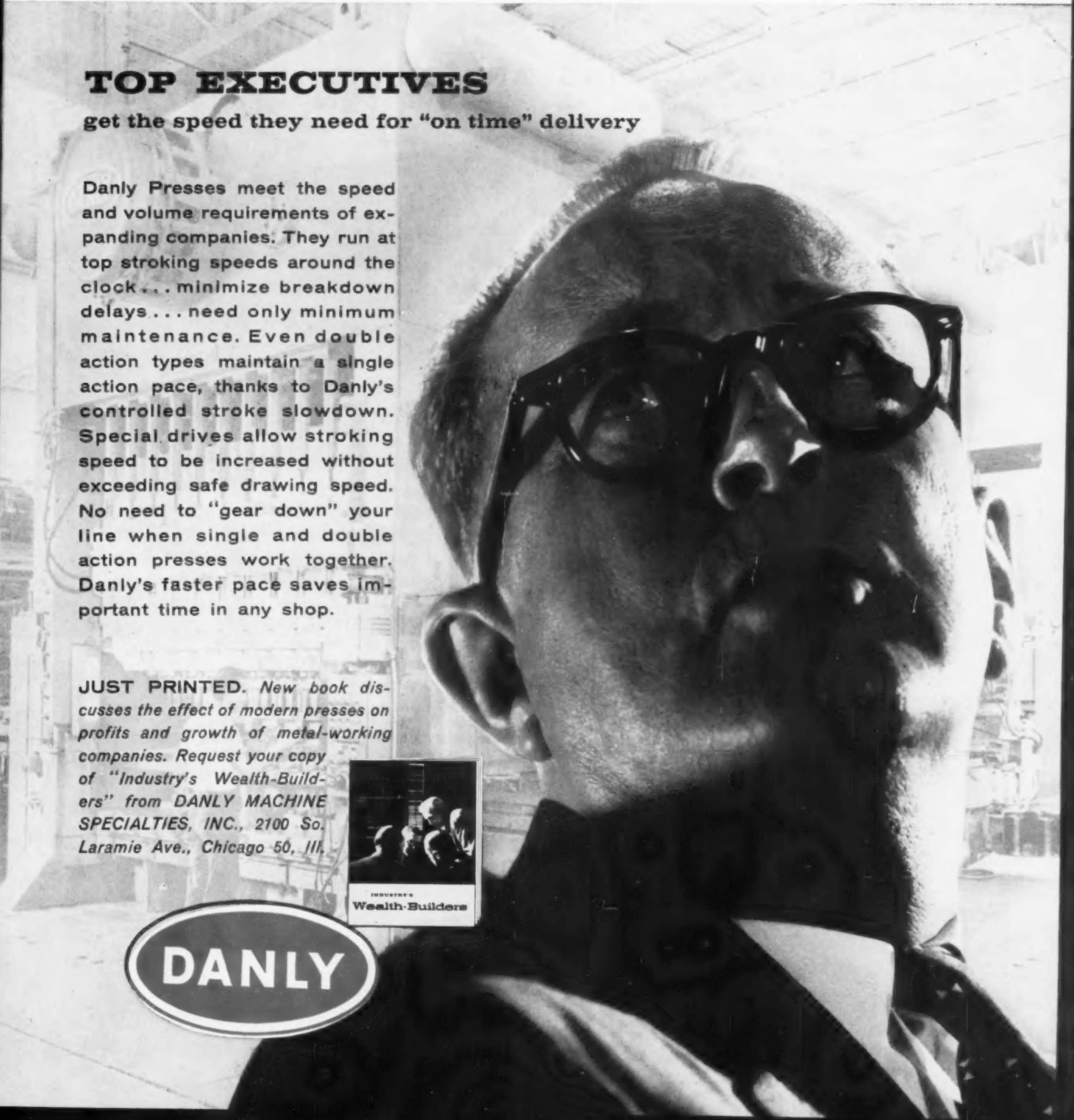
17 Brotherton Road • Cincinnati 27, Ohio

For more information fill in page number on Inquiry Card, on page 223

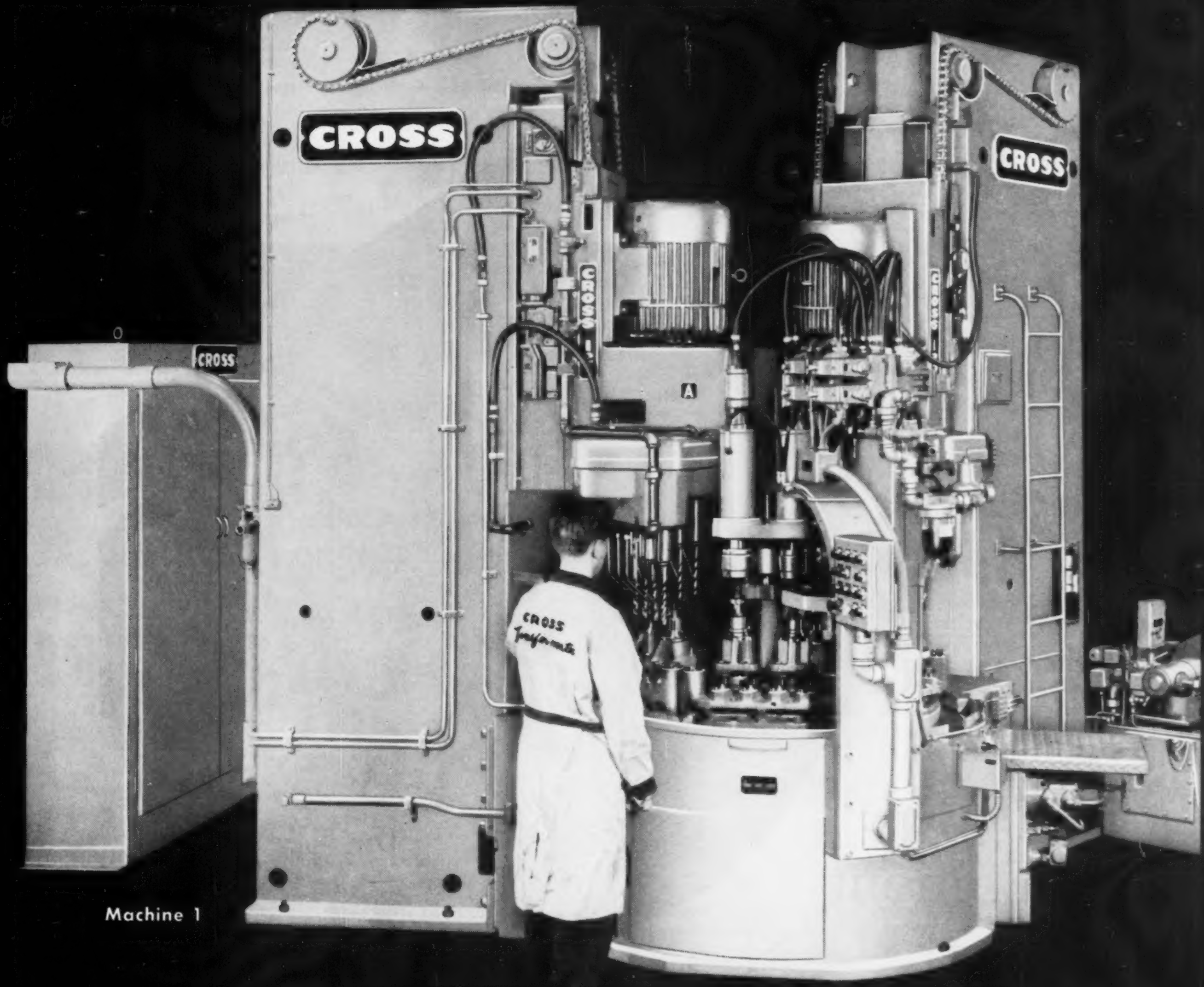
You get what you want with

DANLY

PRESSES



More Specials by Cross



Machine 1

- ★ 800 pieces per hour at 100% efficiency.
- ★ Four parts machined in each station.
- ★ Machine 1 drills and reams rocker shaft hole; forms oil groove; drills one oil hole. Machine 2 drills, chamfers and taps adjusting screw hole; drills, counterdrills and spotfaces second oil hole.
- ★ Push button controlled power wrenches operate fixture clamps.
- ★ Cross "building block" construction provides flexibility for part design changes.
- ★ Complete interchangeability of all standard and special parts for easy maintenance.
- ★ Other features: Construction to JIC standards; hardened and ground ways; hydraulic feed and rapid traverse for drilling and reaming; individual lead screw feed for tapping; automatic lubrication; pre-set tooling throughout.

Drills 417 holes at one time.

How to keep hydraulic equipment in tune

The multiple-spindle machine, shown above, is used in the production of cast iron harps for pianos. It drills 417 holes at one time—from 5/32″ to 7/16″. The large number of spindles makes lubrication a critical factor in keeping production humming.

That's why the machine manufacturer—Zagar Tool, Inc., Cleveland, Ohio—specifies *Texaco Regal Oil R&O* both as a spindle lubricant, and in the hydraulic system which controls the feed of the drills.

Texaco Regal Oil R&O has much greater oxidation resistance than ordinary turbine-quality oils used in hydraulic service. It effectively prevents rust and foam—assures smoother, more dependable service.

There's a complete line of *Texaco Regal Oils R&O*. Let a Texaco Lubrication Engineer help you select the one best for your job. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, New York.

TEXACO

TEXACO Regal Oils R&O

FOR ALL HYDRAULIC UNITS

For more information fill in page number on Inquiry Card, on page 223

- **Perennial Problem—Machine Tools**
- **Mile after Mile**
- **Operation Adjournment**
- **WOC's to be Replaced**

Keeping up with Washington

By Loring F. Overman

DIFFERENCES of official opinion continue to stymie over-all settlement of the Government's machine tool problems. The nearest thing to unanimity was the recent adoption of uniform rental rates for machine tools leased to civilian contractors for defense work. The monthly leasing rates range from 1 3/4 per cent of the cost of a machine tool less than two years old, down to 3/4 per cent for machines more than ten years old. These uniform rates, announced by an inter-agency task group appointed to revamp leasing policy, apply to machines leased to contractors by the three military services and by the General Services Administration.

Rates previously varied with the different agencies, averaging 1 per cent per month regardless of the age of machines. The principal purpose of the new rental policy, according to Defense Mobilizer Gordon Gray, is to make certain that lessees of nearly new, government-owned tools are not given an unfair competitive advantage over companies that own their equipment. This settlement of leasing rates is considered an encouraging first step toward the solution of other problems in the field of machine tools.

How to handle machine tools in mobilization planning continues to puzzle Washington. The Air Force holds that any nuclear war would be decided by equipment in place and in operation, since there would be no time for a buildup after the shooting starts. Machine tools in storage at the time of any possible attack could not be taken out of mothballs in time to be of service. The Navy takes a middle position in such considerations, with Army favoring adequate reserve facilities.

Mile after Mile

Next to the Defense Program, with its more or less constant budget of $38,000,000,000 annually, the new interstate highway project promises big things for builders of big machines. Approved last year by Congress as a 41,000-mile affair, the project is already showing signs of lusty growth. Applications have been made to add 7000 miles to the schedule at an additional cost of $15,000,000,000.

Applicants are states which pay only 10 per cent of the cost of interstate highways and 50 per cent of regular Federal-aid highways. Having a road of the latter type reclassified as a part of the interstate system gives the state a 40 per cent saving, with Uncle Sam picking up the tab for the difference. Pressures for and against the changes are strong.

Operation Adjournment

If Congress is to adjourn by August 15 as has been anticipated, two things are likely: either very little legislation will be approved, or the last-minute rush will carry with it a number of items better left unpassed.

MACHINERY readers may wish to keep members of Congress informed regarding their feeling about:

Proposed wage-hour legislation—This legislation would extend coverage to some four million retail and service employes and six million in other occupations not now covered.

Right-to-work laws—Proposals would repeal that portion of the Taft-Hartley law that affirms the authority of states to outlaw compulsory unionism.

Secondary boycotts—A bill to close loopholes in present Taft-Hartley legislation prohibiting secondary boycotts has been introduced. Business generally favors; labor opposes.

Federal power development—The question is whether ownership of electric-power facilities should be in the hands of Government agencies or private business.

Atomic energy for commercial uses—The issue is whether atomic energy for civilian purposes should be developed by private business or by the Government.

Social security—Proposed is legislation which would raise the taxable wage base from the present $4200 to $8000 a year. Action would increase the cost to employes $450,000,000 a year; employers, the same. The issue: should social security be raised to provide all necessary income for old age, or should it be considered a floor of protection above which individual responsibility for old age is encouraged?

WOC's to be Replaced

The controversial WOC's—the industry executives who serve the Business Defense Services Administration without compensation—will soon vanish from the Washington scene. Loaned by their companies for a six-month tour of duties as heads of twenty-five divisions of BDSA, the WOC's have been the center of much criticism from members of Congress. Critics have pointed out that WOC's were in a position to tip their companies off to up-coming Government projects and to influence awarding of contracts to their own companies. Upon completion of each six-month tour of duty, WOC's will be replaced by Government career men.

HARDINGE
ELMIRA, N.Y.

Variable Speed Machine
for
PRODUCTION DEPARTMENTS

Produce More Precision Parts at Lower Cost with this NEW Second Operation Machine

Send for Free illustrated Bulletin DSM59

• OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette Street, New York, N.Y.

HARDINGE BROTHERS, INC., ELMIRA, N. Y. U.S.A.

For more information fill in page number on Inquiry Card, on page 223

Productivity—One of Our Greatest National Assets

WHETHER increased productivity is the result of competitive pressure or the means whereby effective competition can be developed is a good deal like the old question about the chicken and the egg. The point is that to stay alive and keep going ahead, a concern today must continually increase its productive efficiency. In the period of intensive competition that lies ahead, this truth will be more important than ever.

It is a well-established fact that the steady rise in American productivity over the passing years has provided the drive for our industrial and material progress. It has kept our industries healthy and growing, provided more employment, increased real wages, and pushed up our standard of living. In the past forty years increased productive efficiency has made it possible to decrease working hours per week by 20 per cent, to more than double the real wages of industrial workers, and to add 25 million new jobs. It is just as important to labor as it is to industry that continued increase in productivity be assured.

Productive efficiency results from a number of things, but by far the most important factor is the use of modern manufacturing equipment. In the metalworking industry this means machine tools and allied equipment. Anything, therefore, which encourages the replacement of obsolete machines with efficient, up-to-date equipment is a definite contribution to the maintenance of economic progress.

The importance of keeping manufacturing plants operating on the most economical basis is widely recognized by industrial management. Much study has been given to the devising of formulas and policies to insure the maintenance of productive efficiency at a high level. In many cases long-term modernization programs have been laid out to cover up to ten years.

Provision for the financing of new equipment purchases under long-term programs is usually a problem. More attention might well be given to the development of financial policies that would make available the necessary funds when production efficiency is most needed—in times of a declining economy. Cash or cash-equivalent reserves, earmarked and set aside for this specific purpose and available for use when they would do the most good, would be a powerful influence on the increase of productive efficiency in plants that are staffed with a farsighted management.

Charles O. Herb

EDITOR

STAINLESS DIRECTORY

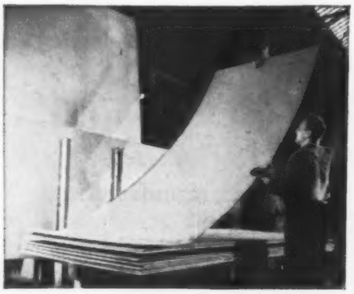
Buyers Guide to Ryerson Stainless Stocks & Services

Here's a quick guide to the nation's largest stocks of stainless steel—2,351 sizes, shapes, types and finishes of Allegheny stainless in stock at Ryerson.

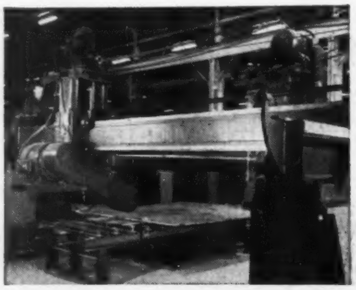
This wide selection assures you of getting the best stainless for every application. Extra care in storage, handling and shipping —such as padded shear clamps to protect finish and flatness of sheets—guards the high quality of Ryerson stainless stocks. And in addition, the help of full-time stainless specialists is yours when you call Ryerson.

See your Ryerson catalog for a complete listing of stocks and call your nearby Ryerson plant for quick shipment of Allegheny stainless—one piece or a truckload.

SHEETS—11 analyses of Allegheny stainless sheets in stock including nickel and straight chrome types. Also extra wide sheets to reduce welding costs.

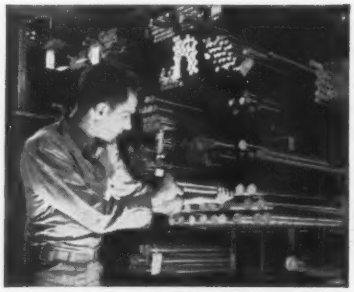


PLATES—Available in 9 analyses including plates to Atomic Energy Commission requirements and to ASTM specifications for code work. Also extra low carbon types for trouble-free welding.

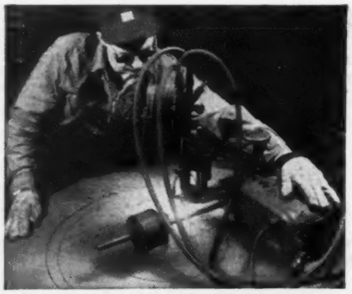


TRUE-SQUARE ABRASIVE CUTTING Stainless plates up to 12' x 25' cut absolutely square on abrasive disc machine. Length and width tolerance plus or minus 1/32".

A NEW STEEL—Type 202 Allegheny Stainless is available in 14 to 26 gauge sheets. Type 202 compares favorably with 302 in corrosion resistance; costs 2¾¢ per lb. less.



BARS AND ANGLES—Rounds, squares, flats, hex's and angles in 8 types including free-machining bars with both analysis and mechanical properties controlled for best performance.



CIRCLES, RINGS, SPECIAL SHAPES —Practically any shape, no matter how intricate, can be accurately flame cut from stainless steel plate by skilled Ryerson operators.

PIPE AND TUBING—Light wall, standard and extra heavy pipe, ornamental and regular stainless tubing. Also flanged, screwed, welding and Quikuple fittings and Cooper stainless valves.

AIRCRAFT STAINLESS—Sheets, strip, plate and bars to Government and Aeronautical Specs. Write for Ryerson Aircraft Steels booklet.

Principal products: Carbon, alloy and stainless steels—bars, structurals, plates—sheets and strip, tubing, reinforcing products, industrial plastics, machinery and tools, etc.

RYERSON STEEL

JOSEPH T. RYERSON & SON, INC. PLANTS: NEW YORK • BOSTON • WALLINGFORD, CONN. PHILADELPHIA • CLEVELAND • CHARLOTTE • CINCINNATI • DETROIT • PITTSBURGH • BUFFALO CHICAGO • MILWAUKEE • ST. LOUIS • LOS ANGELES • SAN FRANCISCO • SPOKANE • SEATTLE

For more information fill in page number on Inquiry Card, on page 223

BROACHING TITANIUM

By L. B. GRAY
Experimental Shop Manager
Orenda Engines, Ltd.
Toronto, Canada

Unusually good results have been obtained in broaching titanium-alloy compressor discs, blades, and other jet-engine parts. Solid broaches are used for roughing, and insert type broaches for finishing. Surface finishes of 32 micro-inches or less are produced.

MACHINING of titanium and its alloys has proved to be far less difficult than was originally anticipated. However, this increasingly important material has certain peculiar characteristics which must be taken into consideration for successful machining.

Even though titanium has a higher strength, the power required for machining is generally less than for mild steel. Chips produced are usually well formed and tightly rolled. While good surface finishes can be produced, the temperatures

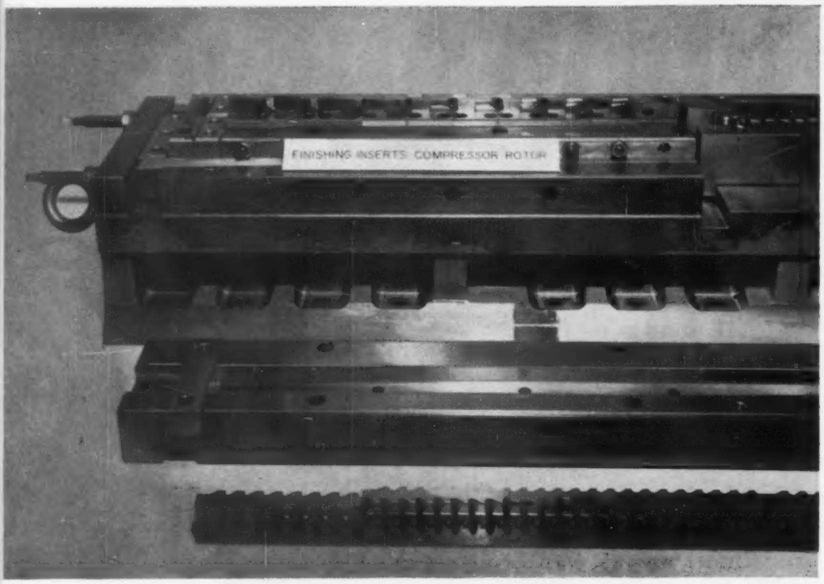


Fig. 1. Part of the broaches used for cutting forged titanium-alloy compressor rotors. Solid roughing broach is in foreground, and finishing inserts at rear.

at the tool cutting edge are high because of titanium's low thermal conductivity. As a result, adequate coolant is essential.

The use of sharp tools, particularly for finishing, is important because dull tools will increase the chance of galling and seizing—eventually leading to failure. Adequate depths of cut are preferred to prevent the tool from rubbing the work and causing work hardening. However, work hardening due to the heat generated during machining is relatively shallow in depth, and multiple passes—as well as shaving operations—can be done successfully.

Broaching is considered by many metalworking concerns to be the most troublesome operation in machining titanium. This has not been the case, however, at Orenda Engines, where excellent results are being obtained with specially designed, carefully made broaches that have a long life. A surface finish of 32 micro-inches or less is consistently obtained in broaching RC-130B, RC-120AM, A-110, and Ti-140 titanium alloys.

Design of Broaches

Solid broaches, such as the one seen in the foreground of Fig. 1, are used for roughing operations, while insert type broaches (shown in

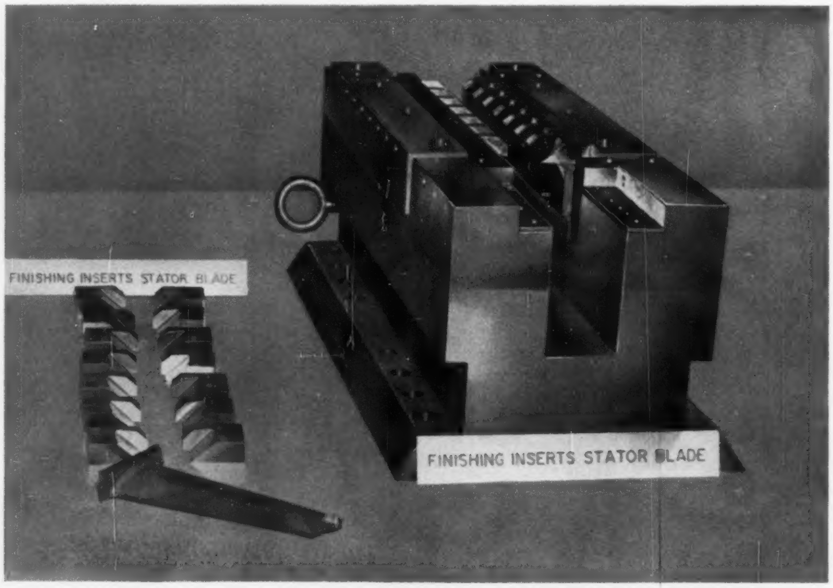
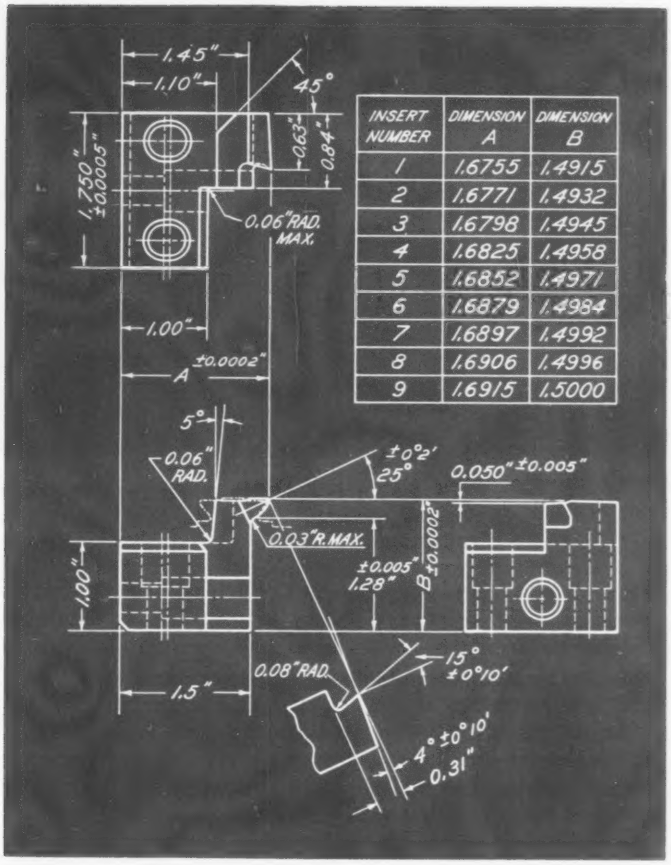


Fig. 2. Insert type broaches, mounted in holder at right, are used to finish roots of titanium stator blades. Inserts alone, and a finished blade, are seen at left.



INSERT NUMBER	DIMENSION A	DIMENSION B
1	1.6755	1.4915
2	1.6771	1.4932
3	1.6798	1.4945
4	1.6825	1.4958
5	1.6852	1.4971
6	1.6879	1.4984
7	1.6897	1.4992
8	1.6906	1.4996
9	1.6915	1.5000

Fig. 3. Typical left-hand insert for broaching forged titanium-alloy compressor discs. Critical dimensions A and B are ground to a tolerance of plus or minus 0.0002 inch.

the background) are employed in finishing. The tools illustrated are used on jet-engine compressor rotors. Finishing inserts and the broach holder for forged titanium-alloy stator blades are seen in Fig. 2.

Although the insert type broaches are more expensive to make, they have been found to be more economical because they can easily be modified to take care of frequent engineering design changes in the root forms of jet-engine compressor discs and blades. Also, inserts have a longer life and produce a smoother finish on the work-pieces because they can be more accurately ground.

A typical insert for broaching titanium-alloy compressor discs is shown in Fig. 3. This is a left-hand insert, but the right-hand inserts are practically the same. In fact, the critical dimensions A and B (given in the table for succeeding inserts) are identical for left- and right-hand inserts. As can be seen, this design permits backing-off, or relieving, in all directions. Then, when from 0.005 to 0.015 inch of stock is removed from the cutting edge in sharpening, the cross-sectional form of the insert remains constant.

In general, a hook (or face) angle of 15 degrees, and a relief (or top rake) angle of 4 degrees is specified for broaching titanium alloys. For inserts, the top rake angle is 4 degrees only at the nose—and decreases at succeeding points around the form. Instead of backing-off the teeth on solid broaches, a side relief is provided on their flanks. This produces a serrated finish on the work-piece.

A typical solid broach, used for the second roughing pass on compressor rotor discs, is illustrated in Fig. 4. The twenty-two teeth on each side are alternately staggered, as shown in the plan view. Accumulative tooth pitch error is held to a maximum of 0.030 inch between any two teeth. Solid broaches are made slightly over size —about 0.0005 inch larger than the maximum dimension to be cut—because titanium acts somewhat as a sponge, and springs back after it has been machined.

Rigidity of the work-piece fixture and toolholder is as important in broaching as with any other machining operation performed on titanium. Fig. 5 illustrates a portion of a typical insert type broach holder, developed by Orenda engineers, that is massive enough to minimize vibration. Two inserts, *A* and *B*, are shown by

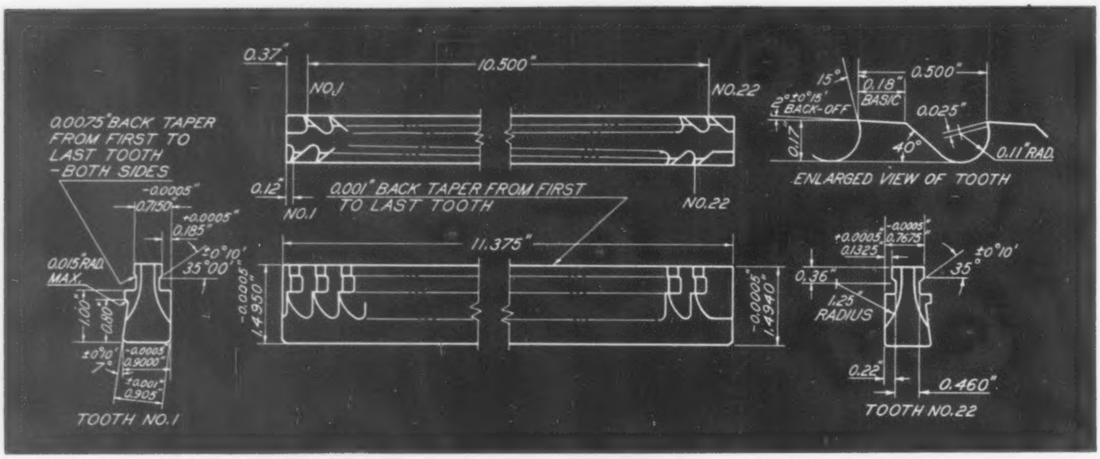


Fig. 4. Solid broach having twenty-two staggered teeth along each side is used for the second roughing pass on forged titanium compressor rotor discs.

dot-and-dash lines in position in the fixture. The inserts are first secured to the bottom bolster of the holder with two socket-head cap-screws in each insert, and then clamped to the side members with one screw in each insert.

An important feature of the broach-holder design is the use of adjustable tapered gibs *C* which permit varying the width of the cut. With the setup shown, an adjustment of 0.020 inch per side is possible simply by tightening or loosening screws *D*. Even more adjustment can be provided by backing up the gibs with packing strips. The end inserts are located lengthwise by mounting against stop-plates *E*, and successive inserts are mounted in contact with each other.

In establishing standards for depths of cut in broaching titanium, it was found that various firms offered sharply different recommendations. The only major point of agreement was that each tooth must perform a job and actually cut material. One school of thought favored heavy cuts of 0.007 to 0.008 inch per tooth, while another

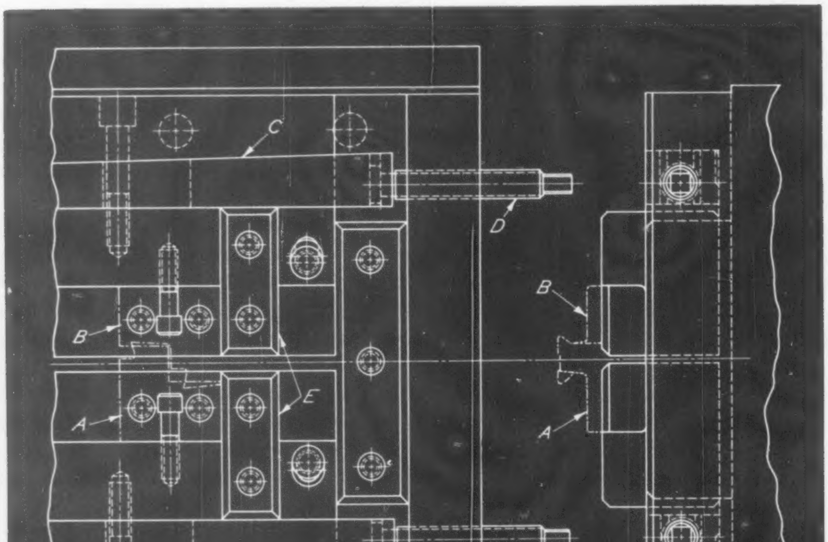


Fig. 5. Part of a typical insert type broach holder with two inserts, (A) and (B), shown in place. Adjustable tapered gibs (C) permit varying the width of cut.

strongly advised broaching cuts as light as 0.0002 inch per tooth.

After extensive experimentation and exhaustive tests, Orenda engineers found that optimum results were obtained with cuts of 0.001 to 0.002 inch per tooth for insert type broaches, and a maximum depth of 0.0035 inch per tooth with solid tools. Also, contrary to most opinions, it was found that excellent finishes and tool life were possible with full-form shaving. In broaching forged titanium-alloy stator blades, 0.002 inch of stock is removed per tooth in roughing, and 0.001 inch in finishing. For titanium compressor discs, stock removal rates for roughing are as high as 0.0035 inch per tooth, and the last full-form insert tooth shaves 0.001 inch of stock from the entire contour.

The total depth of stock removed from each blade-holder slot on one size compressor disc is about 3/4 inch. This is done in four passes—three roughing and one finishing—as shown diagrammatically in Fig. 6. A different holder having a complete set of broaches is mounted on the machine after each pass, or, if production warrants, each pass is made on a different machine.

As seen at the lower right in Fig. 6, the first pass with a solid broach hogs out metal from the center and sides of each slot. The second solid broach roughs out the bottom and lower corners of the slot. Sides of the slot, adjoining the periphery of the compressor disc, are actually finished by the third pass with a solid broach. As seen at the upper left, nine pairs of inserts successively finish the bottom and lower corners, with the last insert shaving the remaining form that has not been finished by the solid broaches. In finishing most blades, only seven pairs of inserts are required—the first three pairs progressively broaching the corners, the next three pairs doing the top of the root, and the last, shaving the complete form of the blade-holder slot.

Broaches Made from 18-4-1 High-Speed Steel

Both the solid and insert type broaching tools are made from an 18-4-1 oil-hardening tool steel, similar to Atlas "Spartan 7," containing 0.72 per cent carbon, 0.25 per cent manganese, 0.30 per cent silicon, 18 per cent tungsten, 4 per cent chromium, and 1.20 per cent vanadium. The blanks are first rough-machined, leaving about 0.100 inch of stock on all surfaces for subsequent removal.

The rough-machined broach blanks are stress-relieved by heating to about 1200 degrees F. The tools are then milled and shaped to the required profile, leaving 0.020 to 0.030 inch of stock to be removed in grinding. Blanks are then preheated

Fig. 6. Four passes are made to complete broaching of slot in compressor disc. Three passes (lower right) are made with solid broaches, and one (upper left) with inserts.

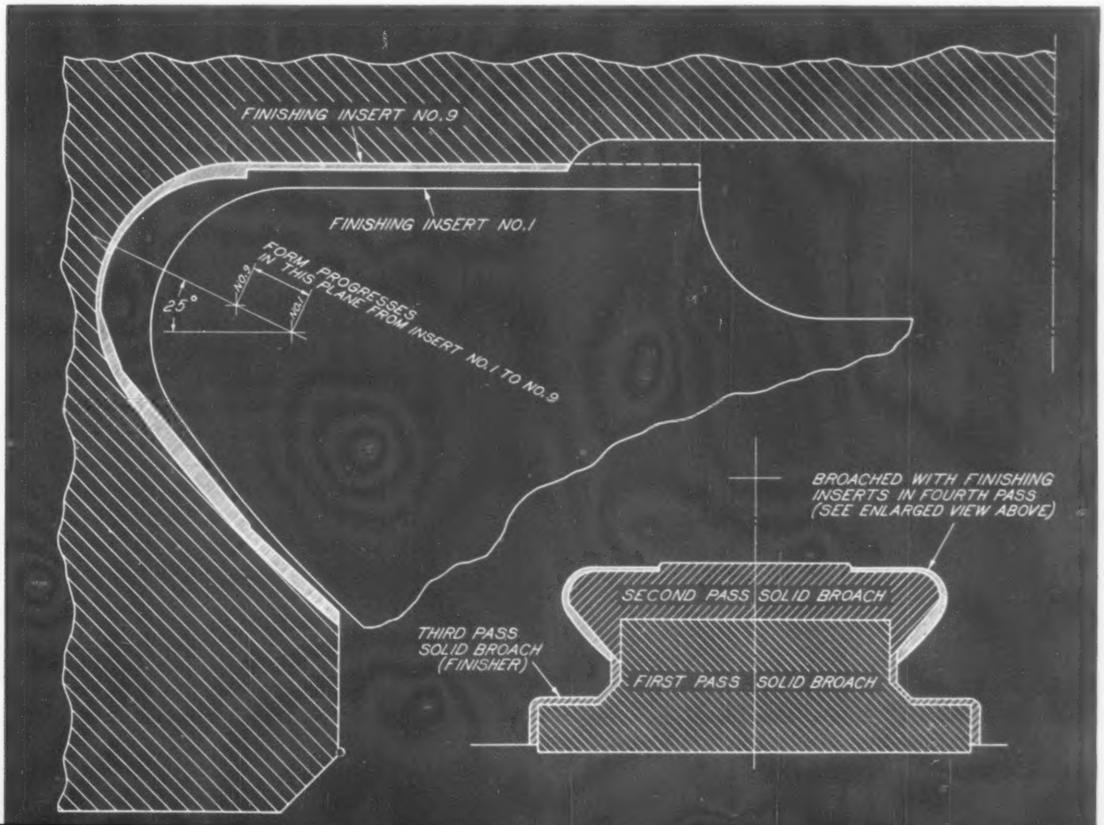


Fig. 7. A complete set of broach inserts, each held at the required height and angle in a special fixture, are finished on this surface grinding machine.

to 1575 degrees F., raised to a temperature of 2300 degrees F., and quenched in oil. After annealing at a temperature of 1625 degrees F., the broaches have a hardness of 63 to 66 Rockwell C.

Finally, the tools are rough- and finish-ground. At least 0.020 inch of stock—and as much as 0.035 inch—is removed in these operations. Since hot titanium chips are plastic, they have a tendency to clog the teeth, and a smooth finish on the tool is essential for chip removal. For this reason, a maximum roughness of 10 micro-inches is specified for the cutting surfaces and full forms in finish-grinding.

The profiles of the insert type broaches are finish-ground on a Brown & Sharpe No. 5 surface grinding machine, Fig. 7. A special fixture mounted on the magnetic chuck of the grinder holds a complete set of inserts—each insert at the required height and angle. A vitrified-bonded, aluminum oxide abrasive wheel of 120 grain size, I grade, and No. 6 structure is used.

A portable Pratt & Whitney Diaform attach-

Fig. 8. Grinding wheel is diamond dressed to the required form with this attachment. The operator manually traces the flat template seen at top center.

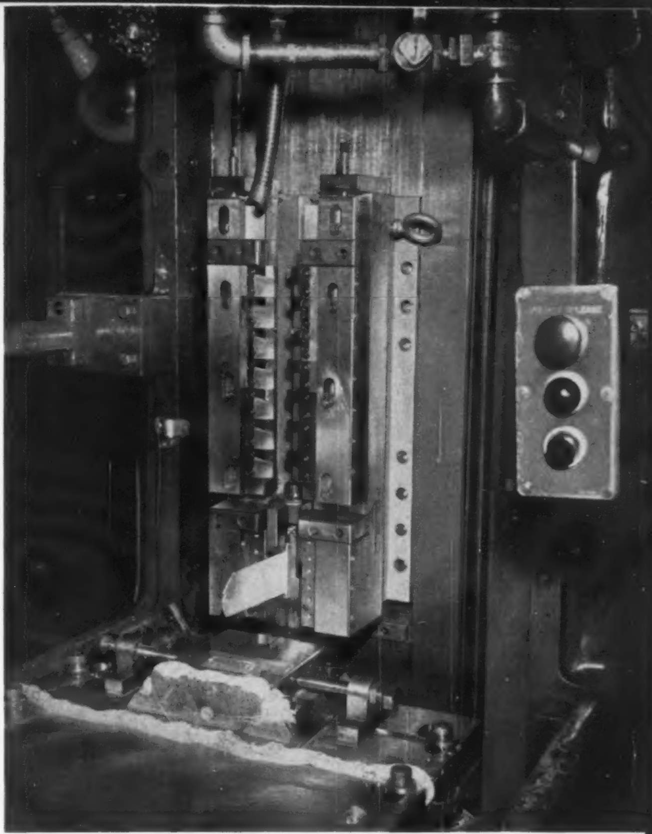


Fig. 9. Close-up view of the insert type finishing broaches used on the machine seen in heading illustration for cutting the root form on blades.

ment is mounted on the magnetic chuck of the machine, Fig. 8, for forming the grinding wheel. The operator simply traverses the tracer over the profile of the flat template. This movement is transmitted, with a 10 to 1 reduction ratio, to a diamond which trues the wheel to the desired form. Two diamonds are provided, one for semi-finishing and the other for finishing. The adjustable template can be tilted to provide the specified relief angle.

Broaching Applications

About 3 tons of pressure is needed for broaching titanium alloys when three or four teeth of a solid broach are in simultaneous contact with the work. The setup on a Cincinnati 15-ton, 66-inch stroke vertical machine for broaching blades is seen in the heading illustration and Fig. 9. The space at the lower end of the insert broach holder has been provided for the installation of additional inserts if required for other size blades. In this instance, roughing with solid broaches and finishing with inserts are completed in one pass.

In performing tests on the only machine available in the experimental machine shop, broaching speeds of about 6 feet per minute were used. However, no trouble is anticipated in raising the ram speeds to 25 or 30 feet per minute for production applications. These speeds are comparable to those presently being used for broaching heat-resistant alloy steels.

Again, in test runs, a general-purpose coolant used for all operations in the experimental machine shop proved satisfactory for broaching titanium alloys. However, for production applications, it is felt that the use of carbon dioxide or sulphurized oil might give improved performance. The work-pieces are backed up with a permanent steel ring or plate to minimize the formation of burrs, and chips are manually brushed from the broaching tools after each pass.

Compressor discs are broached on an American 15-ton, 66-inch stroke, vertical machine, seen in Fig. 10. In setup shown, specimens for tensile tests are being broached instead of discs. The work is held in a completely universal fixture.

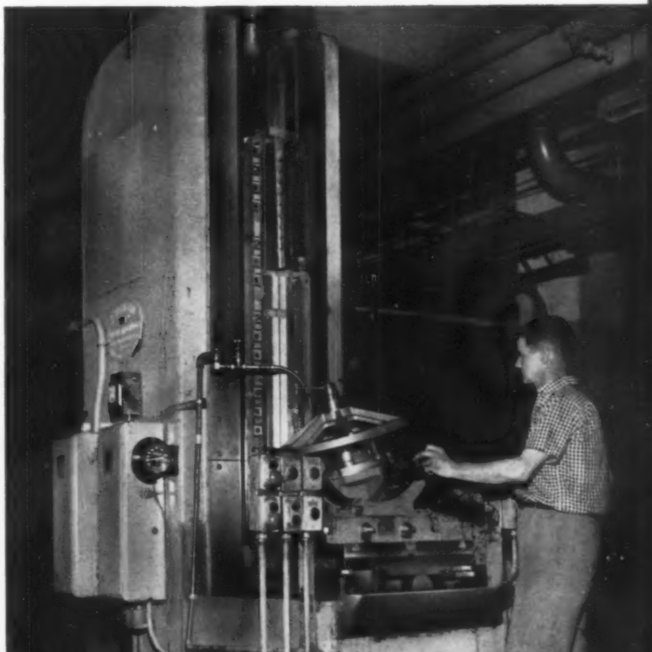


Fig. 10. Vertical machine of 15 tons capacity and having a 66-inch stroke for broaching compressor discs. A universal work fixture is provided.

Double-Crank Dieing Machines in Production at Buick

A bank of ten 150-ton capacity dieing machines that combine the advantages of an underdrive system with two-point suspension is turning out a continuous flow of components for the Buick automobile. These presses were built to conform to the production requirements of several automobile manufacturers.

By RAYMOND H. SPIOTTA
Associate Editor

MANY parts for its latest model cars are being stamped and formed on 150-ton capacity double-crank dieing machines at the Buick Motor Division, General Motors Corporation, Flint, Mich. Ten of the new machines are in operation in the company's sheet-metal plant.

"Unconventional" describes the means by which this particular design of dieing machine found its way into the shops of its first users. Interested groups of engineers, master mechanics, and other responsible persons from several manufacturers of automobiles and automobile components—together with design engineers from Henry & Wright, Division of Emhart Mfg. Co., Hartford, Conn.—pooled their ideas of what features and operating characteristics were desired in such equipment.

As a result of this blending of thoughts, a sketch of a double-crank type of machine emerged, and a schedule of tentative specifications (based on JIC standards) was drawn up. Before the prototype was constructed, being guided only by the artist's conception of the machine's appearance and the table of specifications to which it was to conform, preparations were made to have a substantial number of the dieing machines installed.

One of the biggest single design features of the new machine is the replacement of the previously used single, centrally located crank, with a double-crank arrangement that supports the upper cross-head at both ends. The characteristics of an underdrive system—high-speed operation; accurate alignment; low center of gravity; and a pulling, rather than a pushing, stroke—are

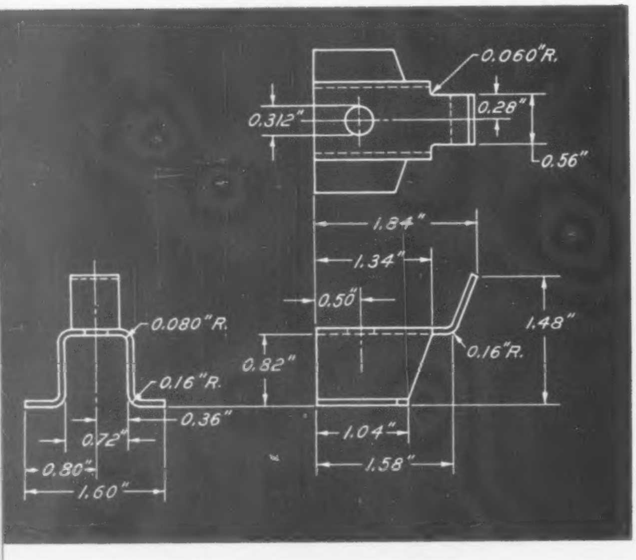
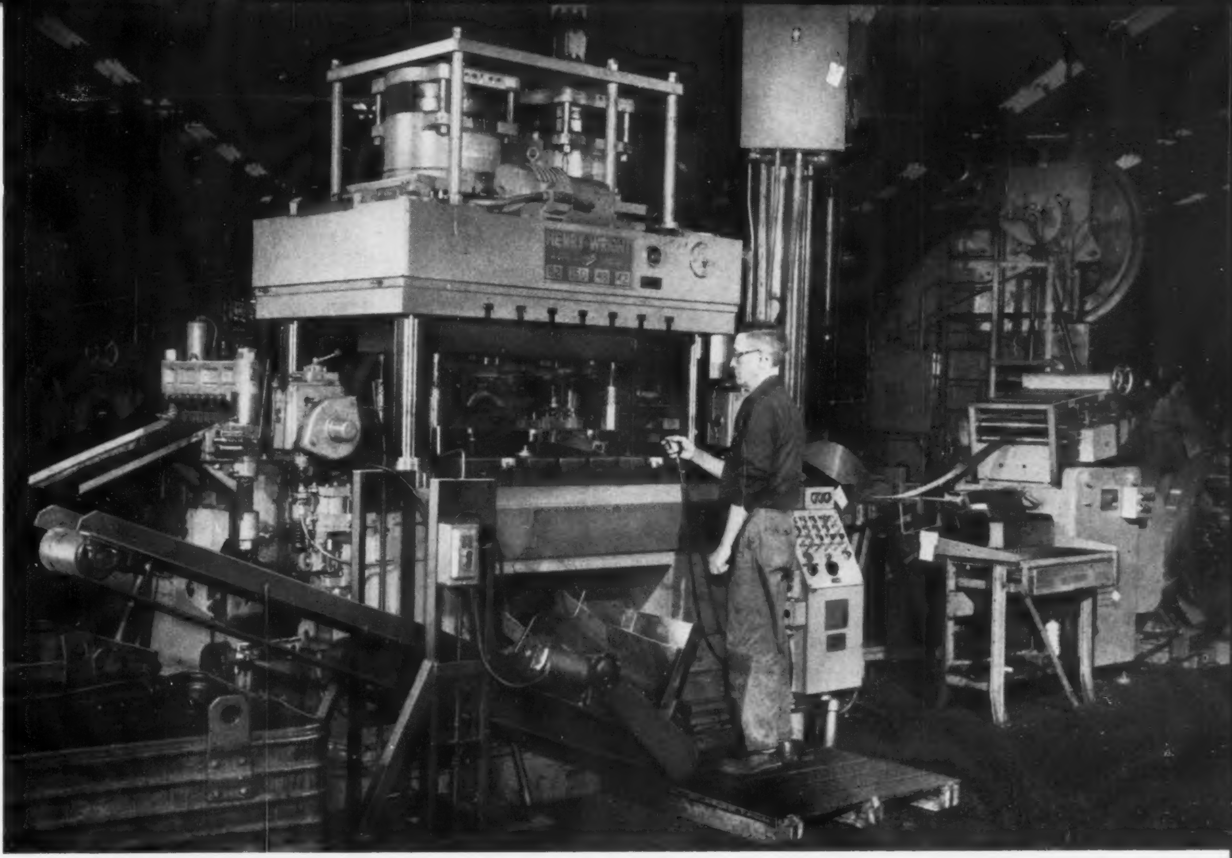


Fig. 1. Hood bumper bracket of 0.075-inch thick mild steel is blanked and formed in a ten-station progressive die on a 150-ton, double-crank dieing machine.



combined with a double-crank to extend the range of work that can be handled with progressive stamping. This two-point suspension principle results in rigidity and strength against off-center loading plus flexibility in the ratio of die-bed area to press capacity. A dampener gasket, in the form of a neoprene-cork-neoprene sandwich, separates the upper base and lower base of the machine to reduce the amount of vibration transmitted to the floor.

On the 150-ton presses installed at Buick (one of which can be seen in the heading illustration) the cross-head measures 42 inches and the bolster 46 inches from front to back, and they both measure 48 inches from right to left. Stroke length for this installation is 7 inches. Eighteen inches is the maximum material width that can be accommodated. Feed length can be varied infinitely up to a maximum length of 12 inches. The barrel-adjusting mechanism for the upper cross-head can be either hand-operated or motor-driven. It is possible to adjust any one of the four barrels

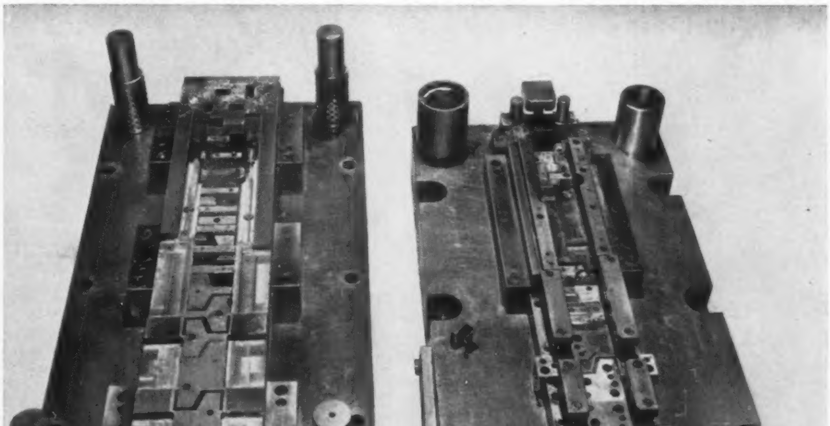


Fig. 2. Both halves of the progressive die used to produce the bracket shown in Fig. 1. One of the completed parts can be seen resting on the die-block at the right—the punch member being exposed at left.

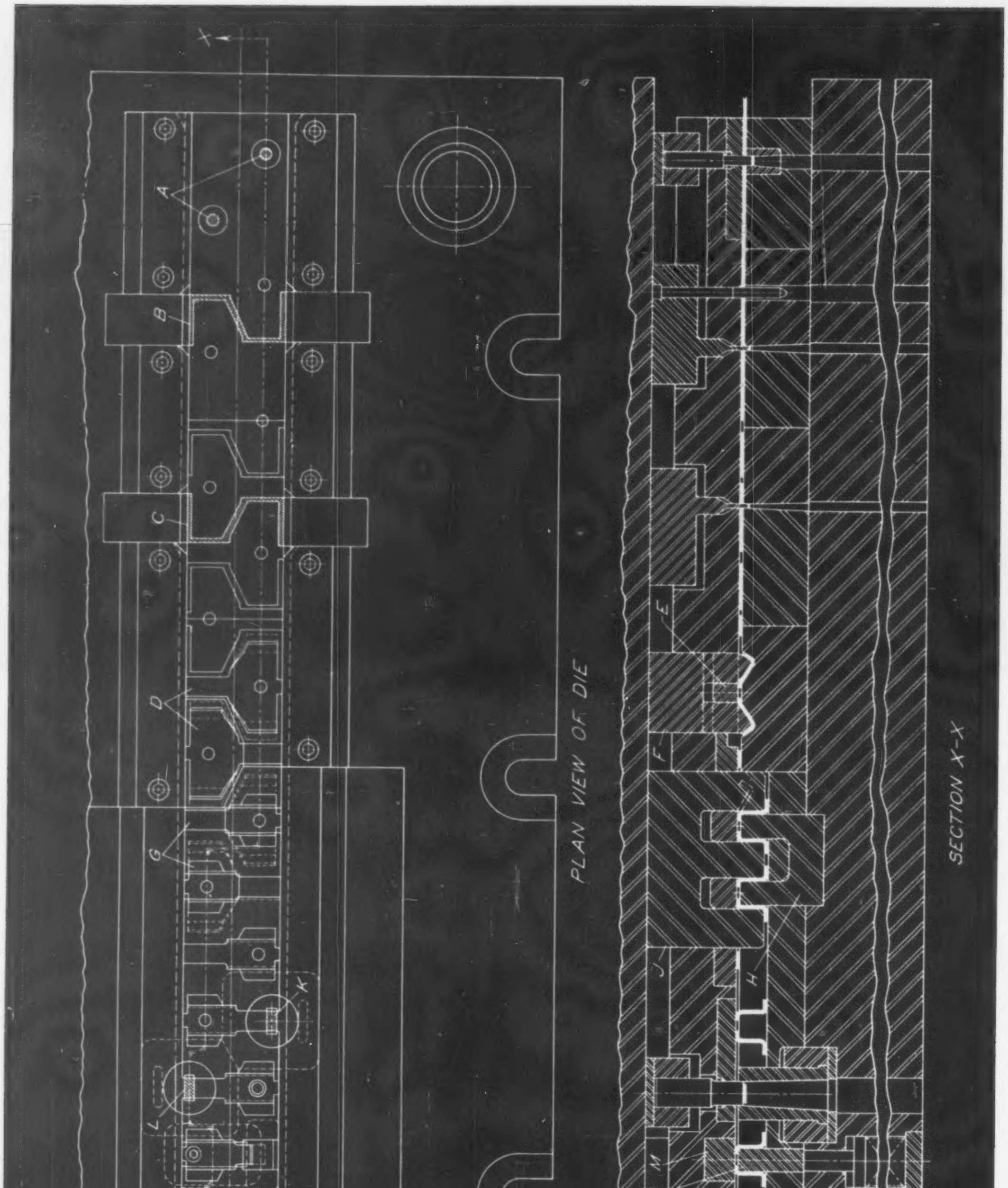


Fig. 3. Ten-station progressive die yields two completely formed brackets with each down stroke of the dieing machine. This large punch and die has a base area measuring 40 by 20 inches.

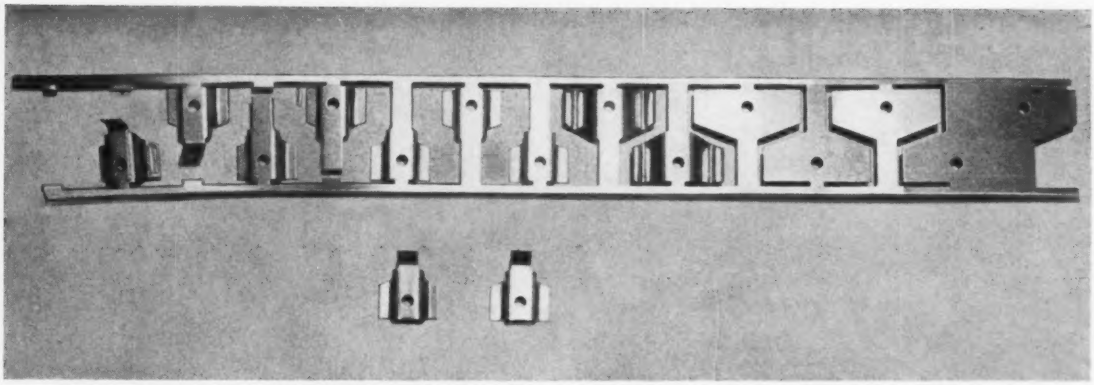


Fig. 4. Die operations on the hood bumper bracket can be seen in this steel strip. After the neck of the part has been freed, the work is advanced by a single tab and a carrier strip.

individually if it becomes necessary to correct for parallelism.

Use of a self-contained, recirculating, flood lubrication system is made possible by the completely enclosed machine frame. The recirculating pump motor and a low-pressure safety switch are interlocked with the press control panel. Thermal switches are located on each main bearing and connection bearing. In the event of an overheated bearing, the affected switch will stop the press and illuminate a warning light on the control panel.

Brackets for hood bumpers, Fig. 1, are being pierced, blanked, and formed in a progressive die that has been designed to make use of 40 inches of the 48-inch long press bolster. Both halves of the tool are exposed to view in Fig. 2. By making the die this long, it was possible to complete two of these parts with each down stroke of the upper cross-head.

A 3 3/16-inch wide coil of 0.075-inch thick SAE 1008 steel is supported in a Sesco roll-straightening unit ahead of the press. From the straightener, the coil stock passes between the feed-rolls of the dieing machine. Both the upper and lower rolls are driven and are connected by completely enclosed gearing.

Pressure of the upper roll is obtained by a pneumatic cylinder. To insure contact across the entire stock width, this roll is cushion-mounted. The feed pitch is provided with a micrometer adjustment and can be varied over the entire range with the machine in operation. The ten dieing machines currently installed are equipped with a drive mechanism that gives an active feed cycle during 180 degrees of crankshaft rotation.

Lubricant is applied to the stock strip by oil-saturated felt rolls as the material passes into the die. A total of one hundred brackets are produced each minute as the machine operates at a fixed rate of fifty strokes per minute, the progressive die yielding two piece-parts during each stroke.

With the driven rolls set for a feed length of 3 13/16 inches, the stock strip enters the first of ten stations in the die shown diagrammatically in Fig. 3. Here, two 0.312-inch diameter holes *A* are pierced—one hole for each of two piece-parts. At the second station, after another feed of 3 13/16 inches, a modified Z-shaped opening *B* is punched across the width of the strip. This opening outlines the adjoining sides of what will be two adjacent parts.

A similar opening *C*, in the form of a letter "S," is punched at the third station. As the strip progresses past this point, the developed outline of each two adjacent, but reversed, brackets is completed. There are, however, two tabs on each part connecting it to the scrap strip to provide a carrier through the die.

The fourth station is inactive. At the next station the legs of both parts *D* undergo a preliminary forming operation. Pressure-pads *E* contact the center portions of the bracket blanks as the punch-holder descends, thus clamping the strip firmly in place. The pressure-pads are recessed into the center of the forming punch *F* which then partially forms the two bends on each leg.

Forming of both legs on each of two brackets *G* is completed in the sixth station. The parts are located on a movable nest *H* that is slotted into the die shoe. Positive gripping is again by means of pressure-pads, sliding within forming punch *J*. After the forming punch has completed the down stroke and returned, the nest retracts to permit free movement of the brackets (still connected to the carrier strips) to the next position.

No work is done on the lower bracket at the seventh station. However, the neck of the upper bracket is freed from the carrier strip by a rectangular punch *K*. The neck of the lower bracket is separated from the carrier strip by punch *L* at the eighth station. At the same time, the neck

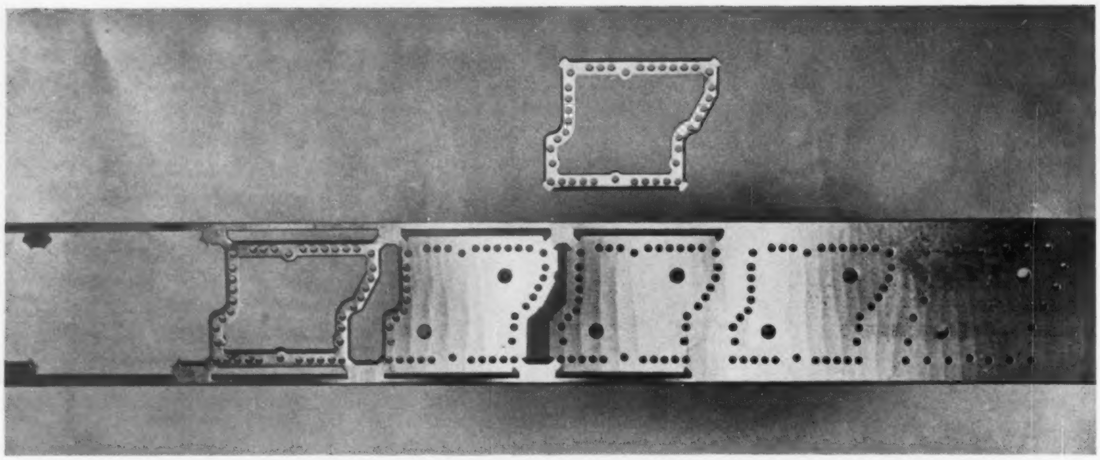


Fig. 5. Oil-screen bodies for the Dynaflow automatic transmission are formed from coils of 0.0345-inch thick steel. Scrap strip as removed from a six-station progressive die is shown.

of the upper bracket is bent up to conform to the specifications on the part drawing. During this bending operation, the bracket—which is, at this point, attached at only one point—is supported between a pressure-pad *M* and a spring-loaded nesting member *N*.

At the ninth station, the neck of the lower bracket is bent up by forming punch *O*. While this bending is taking place, the last connecting tab on the upper bracket *P* is punched out. On the up stroke of the dieing machine this part is permitted to drop freely through the die, out of the press, and into a waiting tote box. Another punch removes the single tab still holding the lower bracket *Q* at the tenth and final station. This completed part then, too, falls into the tote box. The progressive forming stages of the bracket can be followed by referring to the scrap-strip shown in Fig. 4.

As the two carrier strips leave the die they pass through a scrap cutter. The unit, which is a standard part of the dieing machine, is of the pull-down type. An eccentric on the crankshaft operates the automatically lubricated driving mechanism. Movement of the scrap cutter is independent of the cross-head motion. Optimum timing of feeding and piloting is facilitated by the lagging of the eccentric behind the throw of the crank.

Another interesting part being produced on this new installation is an oil-screen body for the Dynaflow automatic transmission. These parts are stamped from coils of 0.0345-inch thick SAE 1008 steel. The scrap strip and one of the finished stampings can be seen in Fig. 5.

In Fig. 6 is shown the progressive die in operation. Six stations are utilized to complete the stamping, the part being carried through the tool by four corner tabs connected to the carrier strips. At the fifth station, the central opening is punched out and two of the four outer edges are turned downward, the other two outer edges having been formed in the previous station. As was the case with the hood bumper brackets, the scrap cutter chops the two carrier strips into short lengths for convenience of disposal.

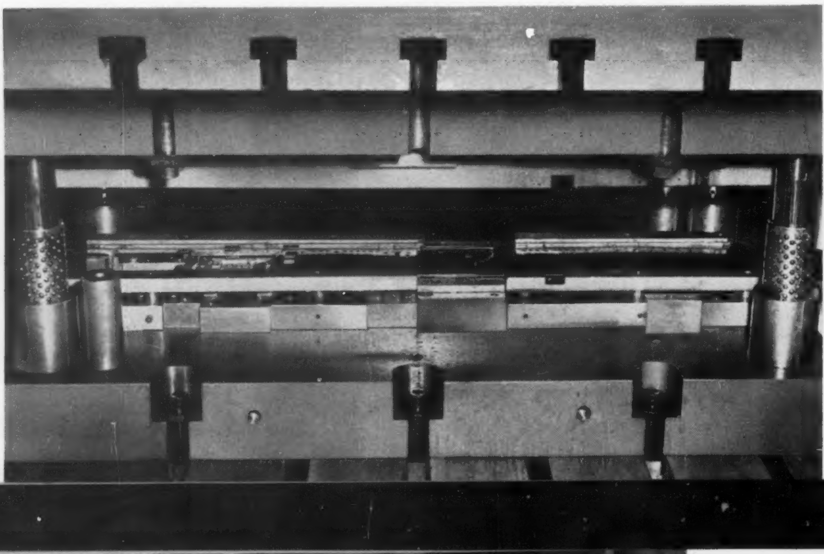
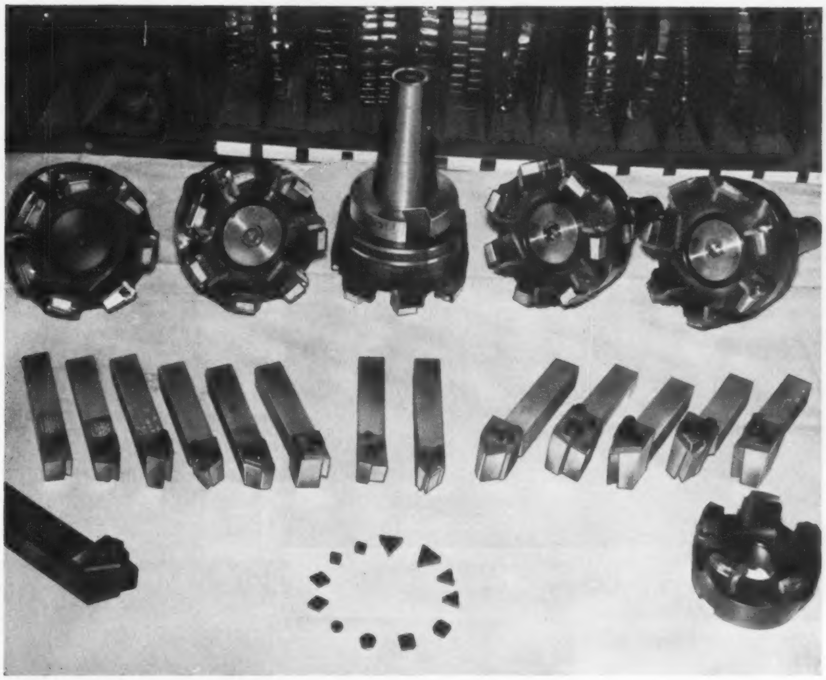


Fig. 6. The punch and die members used to produce the oil-screen body, shown at the top in Fig. 5, are in operation on a 150-ton, double-crank dieing machine. A scrap cutter (not illustrated) shears the carrier strips into short lengths.



Convair Economizes with Throw-Away Insert Tooling

By WILLIS L. CARR, Assistant Foreman
Convair (San Diego)
A Division of General Dynamics Corporation

THE high production schedule followed in building the F-102A delta-wing, all-weather interceptor at the Convair (San Diego) division of the General Dynamics Corporation, has necessitated the use of tools in the machine shops that would require the least amount of maintenance. Being aware that the upkeep cost of brazed tooling was too high, and knowing that many companies have realized the advantages of using throw-away insert type tools, Convair launched an investigation in this direction.

A considerable number of experiments were made with a few single-point throw-away tools from one manufacturer. When these proved satisfactory, tools from other firms were brought in and tested under similar conditions. Finding that some tools work as well as others, the deciding factor for selection was based upon styles available, simplicity of design, and compactness. An array of the many types of Vascoloy-Ramet single-point lathe tools and multiple-point face-milling cutters being regularly used in the shops is shown in the heading illustration.

As with any new tools, machines, or systems, it is important that each man involved be completely familiar with its operation. After changing to throw-away tools, classroom meetings were held to explain how the tools should be handled and to answer any questions pertaining to the cutter operation. Since considerable information had been compiled before the change-over was made, performance data was available. Speed and feed charts were distributed, in addition to information on the grades of carbide in stock and the grades to be used on each material.

In the case of single-point tools, all insert tips

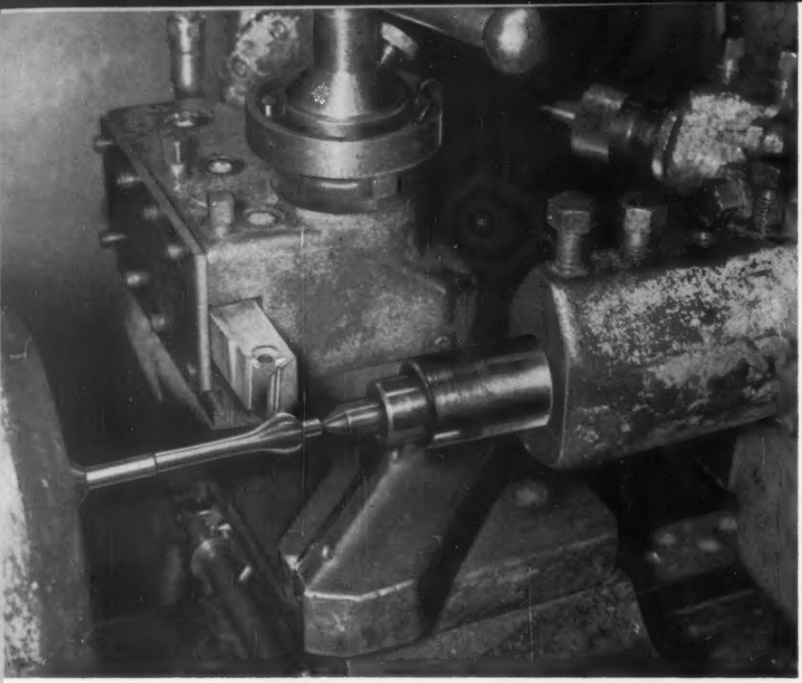


Fig. 1. Turning a titanium eyebolt with a tracer attachment mounted on the rear cross-slide of a turret lathe. The tool-holder, which is mounted in an inverted position, supports a 3/8-inch triangular carbide insert.

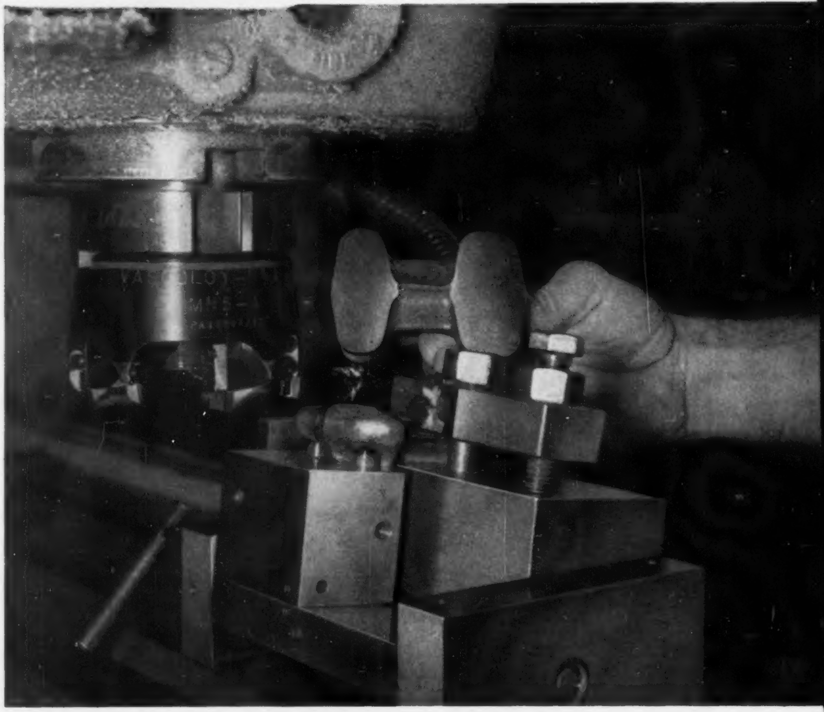


Fig. 2. The base of this titanium component has been machined by a 4-inch diameter, five-tooth milling cutter using 3/8-inch square throw-away inserts. A 7-degree clearance angle is provided on each of the four cutting edges of the tips.

are color-coded to facilitate identification of the different grades. This method is not advisable for multiple-point tools, however, because of the requirements of close indexing to obtain maximum tool life. When a tool is put into production, it is important that each insert is changed at the proper time to obtain the full benefit of all cutting edges. At the end of the production machine shop program for the F-102A aircraft, all turning and facing operations were being performed with throw-away insert tooling, as were about 60 per cent of all the face-milling operations.

To get the greatest economy from each tip, negative-rake tools are utilized in almost all applications, regardless of material, with the exception of small-diameter turning operations and thin-section facing operations. In these cases, positive-rake tools are used. Due to the low cost and extensive grade selection of throw-away inserts, considerably higher feeds and speeds are obtainable with a minimum amount of machine down time due to tool maintenance.

Since the majority of turning operations are accomplished on work-pieces that are 2 inches

in diameter or less, material such as 7075-T aluminum; SAE 4130, SAE 4340, SAE 52100, and stainless steels; titanium alloys; and Hy-Tuf are readily worked at near-machine capacity. Surface speeds range from 200 feet per minute on titanium to 800 feet per minute on high-tensile alloys with no limits on aluminum.

An eyebolt of AMS 4925 titanium is shown being machined in Fig. 1. The work is being performed on a Jones & Lamson No. 5 turret lathe equipped with a tracer attachment on the rear cross-slide. The tracing unit is tooled with a 3/8-inch triangular throw-away insert. A positive-rake and a 15-degree lead angle are provided by the tool-holder. Since the attachment is on the rear cross-slide, the tool-holder is inverted, and the bottom surface is exposed to view. In this operation, the surface speed of the titanium work-piece is 200 feet per minute at a feed rate of 0.005 inch per revolution. Depth of cut is 0.100 inch.

Materials such as SAE 4130 steel, having tensile strengths below 145,000 psi, are consistently machined at surface speeds of 600 to 800 feet per minute. Those materials falling in the range of 150,000 to 200,000 psi are machined at surface speeds of 450 to 600 feet per minute. It is common practice to obtain an average of 200 cubic inches of stock removal per corner when machining materials such as SAE 4340 with a depth of cut averaging 0.350 inch and a surface speed of 500 feet per minute.

After throw-away inserts had been used successfully in turning operations for a substantial period of time, it became apparent that comparable advantages might be obtained by using the throw-away tip principle in milling cutters. Since there were no cutters of this type available, tools were designed and produced to accommodate the disposable cutter principle. This proved to be rewarding, since the rates of speeds and feeds obtainable were greatly increased.

Brazed-tip milling cutters are currently being replaced by the throw-away insert type. Presently being used in the shop are 4-, 6-, and 8-inch diameter negative-rake cutters and 4- and 6-inch neutral-rake cutters—all using 3/8- and 1/2-inch square tips with a 5-degree peripheral lead angle. Also being used are 4- and 6-inch diameter neutral- and negative-rake cutters that use an 80-degree diamond insert for square-shoulder milling applications. Convair hopes to realize a net saving of about $35,000 per year in the cost of carbide milling cutters.

Two of the big advantages of using throw-away tip inserts to obtain greater speeds are the lack of heat strains, apparent in all brazed type tooling, and the fact that the inserts are less expensive. The lack of brazing strains in the insert type tools permits the use of harder grades of carbides, thereby providing the needed performance at higher surface speeds. To obtain maximum tool life, especially in milling cutters, all roughing and facing operations are performed with chamfered corners on the inserts rather than rounded corners. The reason for this is that the extreme heat generated by thinning the chip at the lower portion of the radii tends to break down the carbide.

Fig. 3. A 6-inch diameter, seven-tooth cutter is used to form a T-section from a solid aluminum block. Surface speed of 2000 feet per minute is combined with a table feed of 35 inches per minute and a 0.350-inch deep cut.

An aircraft component of AMS 4925 titanium is shown in Fig. 2 after having its base cut to size on a No. 5 Kearney & Trecker milling machine. The specially designed 4-inch diameter milling cutter has five teeth, with neutral radial- and axial-rake angles and a 30-degree peripheral cutting-edge angle. Seven-degree clearance angles are provided on all four sides (four cutting edges) of the 3/8-inch square inserts. A surface speed of 95 feet per minute was combined with a table feed of 1.5 inches per minute and a depth of cut of 0.250 inch to do the job.

The T-section shown in Fig. 3 is being machined from a 7075-T aluminum block. A deep cut—0.350 inch—is taken at a surface speed of 2000 feet per minute with a table feed of 35 inches per minute. The seven teeth on this 6-inch diameter cutter have neutral radial- and axial-rake angles and a zero peripheral cutting-edge angle. The inserted tips are diamond-shaped and have two cutting edges.

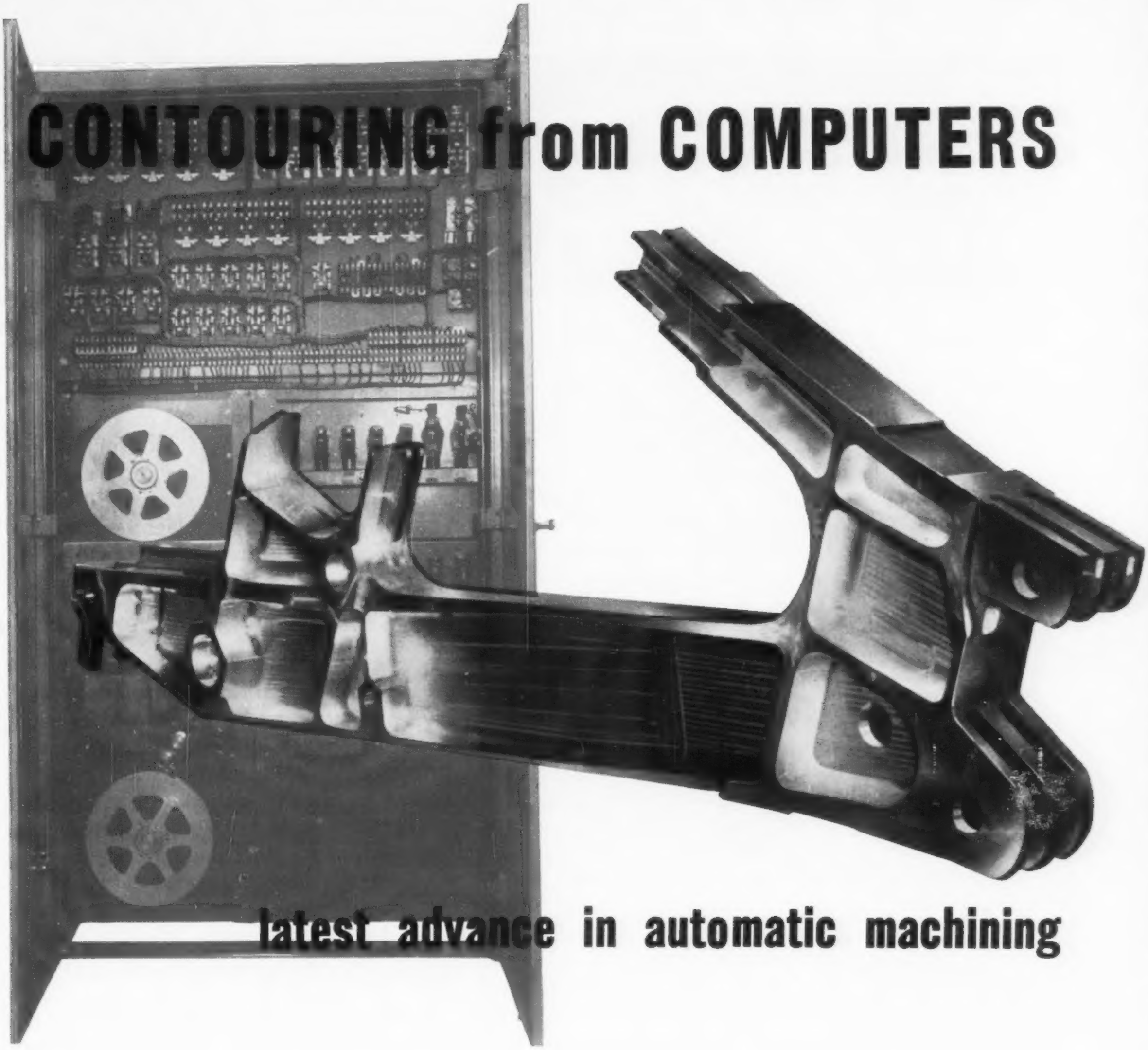
Best results from cabide inserts can be realized by using them under comparatively heavy load. On one production run, SAE 4340 steel billets, having a tensile strength of 145,000 psi, were machined in three passes. For the first cut, a 6-inch diameter, five-tooth negative-rake tool was operated at a surface speed of 500 feet per minute, a depth of cut of 0.100 inch, and a feed rate of 0.007 inch per tooth. Under these conditions, a total of 75 cubic inches of metal was removed per cutting edge on the combined five inserts. Since each tip has eight cutting edges, a total of 600 cubic inches of stock was removed by each set of inserts.

The last two passes were made at the same speed and feed rates. Depths of cut were changed, however, being 0.400 inch for the first pass and 0.350 inch for the second. Total stock removal per cutting edge on the combined five inserts increased to an average of 200 cubic inches—a total of 1600 cubic inches per set of inserts.

Relation between the depth of cut and the size of the carbide tip can be seen in Fig. 4. A 0.200-inch deep cut has just been completed across the surface of this SAE 4130 steel part (180,000 psi tensile strength). The 4-inch diameter cutter has five teeth with 6-degree negative radial- and axial-rake angles and a 5-degree peripheral lead angle. Each of the 3/8-inch square tips has eight cutting edges. The pass was made with the cutter operating at 500 surface feet per minute and the table feeding past at a rate of 9 inches per minute.

In addition to these face-milling cutters, side-milling cutters are also being introduced into the shop. They are being supplied in left- and right-hand styles in diameters of 6, 8, and 10 inches, with the number of teeth equal to the diameter plus one. Although the side-milling cutters have not as yet been appraised under actual production conditions, results similar to those obtained with face-milling cutters are expected.

Fig. 4. Eight cutting edges are provided on each of five 3/8-inch square throw-away carbide tips. The 4-inch diameter cutter has 6-degree negative radial- and axial-rake angles and a 5-degree peripheral lead angle for machining this SAE 4130 steel component.



CONTOURING from COMPUTERS

latest advance in automatic machining

By JOHN L. DUTCHER
Metalworking Machinery Engineering
Apparatus Sales Division
General Electric Co.
Schenectady, N. Y.

CONTROLLING the path of a profiling tool from numerical data—called numerical contouring—is an approach to the production of machined parts that is distinctly new and different from the older template tracer technique. It is of importance to every manufacturer who handles intricate work in small or medium lots.

A hypothetical situation will explain this point. Suppose one plant produces a simplified version of the general type of part shown in the heading illustration. It is to be machined from solid aluminum. Tolerances are on the order of plus or minus 0.005 and 0.010 inch. Required machining is fairly complex because several curved surfaces have to be profiled and a pocket has to be milled. On a tracer-controlled profile milling machine, slightly over one-hundred man-hours are required to prepare templates and tooling. Actual machining time amounts to four hours per part.

Suppose a second plant, producing the same part, has numerical contouring equipment. Here, a programmer spends about an hour and a half studying the drawing, determining the sequence of cuts required, tabulating the necessary dimensions on a standard form, and copying this information on punched paper tape. Then, less than

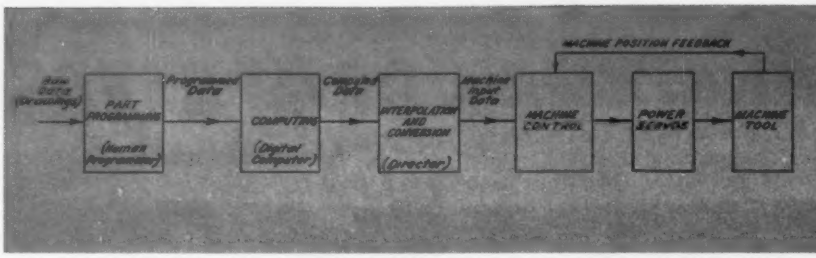


Fig. 1. Basic functions performed by a numerical contouring system.

one hour is required to run this tape through computing equipment to obtain magnetic tape which completely describes the machining operation. This tape is sent to the shop where a tape-controlled machine produces the part in only thirty minutes, using relatively simple tooling. Thus, numerical contouring affords a 40 to 1 reduction in preparation time, and an 8 to 1 reduction in machining time. These ratios, of course, will vary widely with the type of part, but this example is reasonable.

Two Types of Numerical Control

There are two different types of numerical machine-tool control. The simpler of the two is often called *numerical positioning control.* This type is used on machines, such as drill presses, in which the tool must be positioned to a series of points, with some drilling or other machining operation taking place at each point. No particular concern is given to the path to be followed by the tool between these points, since no machining is done during this time. The control merely positions the tool to each point in sequence, the coordinates of the points being provided in numerical form on punched cards or tape.

These intermittent positioning systems are applied to punch presses, drilling and boring machines, and spot-welders. In addition, they can be applied to some machines that must take a cut while moving from one position to the next—providing the cut is straight, and is directly in line with the machine slides. A step-turning lathe is a good example. Numerical positioning control has a promising future but is described here only to differentiate between it and *numerical contouring*—the second type of numerical machine-tool control, and the principal subject of this article.

Numerical contouring differs from numerical positioning control in that the path of the tool is continuously controlled, permitting complex two- and three-dimensional shapes to be machined. The technique is being applied to various types of milling machines. The largest use seen at present is in the aircraft industry, for machining spars, integrally stiffened skins, and other structural parts that would normally be produced on tracer-controlled machines. Other uses include milling, or possibly grinding, various types of cams and turbine blades and buckets. Die-sinking and the production of many other types of machined parts or models of intricate shape are distinct possibilities.

A Complete Process

Numerical contouring is a complete manufacturing process rather than simply a new machine-control system, and must be considered as such. Its most efficient use requires some changes in thinking and procedures all the way from the initial design to the inspection of the finished product. There are eight or more companies who have developed, or are well along in the development of, numerical contouring systems. While these systems differ from one another greatly in detail, and some have many advantages over others, all of the more complete ones follow a similar functional pattern.

This functional pattern is generalized in the basic system shown in Fig. 1. Numerical contouring systems start with the raw data as presented on the drawing of the part. When the part is to be produced for the first time, it is programmed. This consists of studying the drawing to determine the sequence of cuts required, tabulating the necessary dimensional and other information on a standard form, and copying this data on punched paper tape or cards.

The tape or cards are fed to the computing and interpolating equipment which produces positional information of essentially a continuous nature for each machine slide, and the machine control translates this information into commands to the power servos that move the machine. In all present systems, the computing, interpolating, and machine-control functions consist of either two or three physically separate units, with data storage in the form of paper or magnetic tape between them.

Roughly 125 machine tools with numerical contouring equipment are now, or shortly will be, on order. To understand why the future for

numerical control is so bright, it is only necessary to examine some of its advantages.

A study has shown that in the machining of aluminum parts of the type that could effectively be handled by numerical control, the majority of machines now in use are actually removing metal less than 10 per cent of the time. It is hoped that numerical control can raise this to about 75 per cent; but even if it were raised to only 30 per cent it would increase output substantially.

Another factor of importance is that tracer-controlled machines require a template area approximately equal to the work area. Since numerically controlled machines do not require templates, the machines can be much smaller and generally require less floor space. Sometimes, the initial cost of a machine tool equipped with numerical contouring is less than that of an equivalent template tracer machine.

Again, lead time—the time between a completed design and the production of the first part—is of extreme importance, particularly in the construction of prototypes. A good example is the development of new blade designs for jet engines. After a new blade is designed on paper, it is necessary to have a few samples for testing, or possibly enough for a few complete engines. In many cases, it takes six to fourteen weeks to progress from the completed drawings to the first three-dimensional model from which blades can be duplicated. With numerical control, this lead time can be reduced to a few days.

Accuracy of the finished part is increased appreciably. Setup errors are reduced because the procedure is simpler and fewer setups are made. Errors in making and setting up templates are, of course, eliminated, along with the templates. The machine is more accurate because of more compact construction and the added attention being given to its mechanical design.

Human errors are minimized, because of the high degree of automatic operation involved. The numerical equipment checks itself, to a large extent, and automatically stops when it does make an error—in most cases before serious damage to the part results. Another advantage is the greatly increased accuracy with which production rates can be predicted and controlled.

Personnel Must be Trained

For machining operations where numerical contouring can be applied effectively, the added cost of equipment will easily be paid for by increased production, but its efficient use will require some evolution in design and manufacturing procedures and the training of specialized personnel. Although numerical contouring can be used to make parts that are described by drawings of the conventional type, it can be more effective if some changes are made in the method of presenting part data. An effort should be made to keep as much data as possible in numerical form. Dimensioning parts by the use of a system of coordinates, and specifying dimensions with decimal, rather than fractional, notation will help.

The programmer who prepares the part data for the computer is of extreme importance. He must know simple mathematics and understand functionally the operation of the numerical system. He must also know tooling, planning, machine-shop practice, and the characteristics of the machine tool involved. It is necessary, in addition, to acquire and train specialized electrical maintenance personnel.

Four Basic Functions

Of the several numerical contouring systems now available, no two approach the over-all problem in exactly the same way and, in most cases, there are differences of major significance. They vary, first, in the techniques used at various points and, secondly, in the manner in which different functional blocks are combined in the two or three physically separate units that make up the system. This combining of various functions into separate units is important because it has a direct bearing on flexibility and economy.

No attempt will be made here to discuss any system or parts of systems in detail, but for an understanding of what numerical contouring involves, it is necessary to consider some of the different approaches that may be used. There are four basic functions to be performed: programming, computing, interpolation and conversion, and machine control.

Programming—The combining of the dimensional data on the part drawing with tooling and machining knowledge to produce a written sequence of operations is programming. This manuscript describes each section of roughing and finishing cut that must be taken, and notes all auxiliary functions that must be carried out during the machining of the part. Programming can be understood from the drawing in Fig. 2. This is a simplified section of the part shown in the heading illustration. For clarity, only a portion of a single profiling cut (represented by the broken line) will be described, and it will be assumed that the part has already been roughed out, also by numerical control.

A somewhat unusual drawing technique is employed in Fig. 2, where rather than dimensioning the part directly, the coordinates of all of the critical points are given with respect to a pair of reference axes. Drawings dimensioned in this

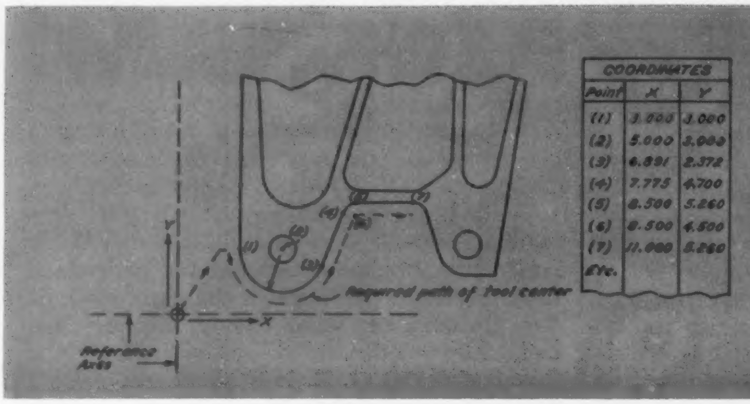


Fig. 2. Drawing of a section of the part shown in the heading illustration. Dimensions are given in decimal coordinates.

way simplify the work of the programmer, although it is also possible to use conventional drawings. In this instance, the programmer decides to use a 1-inch diameter cutter, orient the work on the machine as shown in the drawing, and select a feed rate of 30 inches per minute. He will start the cutter from the reference axes, and it will follow the path of the broken line.

All necessary information is tabulated on a special form similar to that shown in the accompanying table. This data describes each section of cut in sequence. The coordinates of the work at the start and end of each section of cut are given, along with the coordinates of the center where a radius must be cut (or constants for other types of curves). The nature of the surfaces are designated—straight line, arc of a circle, section of an ellipse, empirical curve, etc. For curved surfaces, the tolerance to which the computer must work is specified. The data also indicates whether the tool is to be to the left or right of the work surface, the diameter of the cutter, the feed rate, when the spindle should be started and stopped, the spindle speed, when coolant should be turned on and off, and other necessary machine functions. While this describes a very simple profile cut, the procedure applies also to work involving simultaneous motion in three or more directions.

Computing—The manuscript produced by the programmer describes only the end points of each section of cut to be made, and the dimensional information it contains refers to the dimensions of the part rather than the path of the tool. For cutting a circular arc, this data consists of the coordinates of the end points, and the coordinates of the center of the arc. The computer, knowing the tool radius, automatically calculates a series of data points along the path that the *center of the tool* must follow. It can do the same for hyperbolic, elliptical, empirical, or other curves.

Data points along the tool center path are computed in sufficiently small increments so that the straight-line path of the tool between points is still within curved-deviation tolerance. Or, if a slightly more complex interpolator, capable of faring a second-order curve through a series of points, is used with the computer, less data points are required.

There are three possible approaches to this computing problem. In the simplest form, the necessary calculations can be done manually with a desk calculator, or with occasional aid from an office machine. While this approach has been used in some cases, it is gradually being discarded because it is an extremely long, time-consuming process.

The most economical approach is to transcribe the fairly brief data produced by the programmer into punched cards or tape, and allow the complete function to be carried out automatically by a digital computer. Either a special-purpose or a general-purpose computer can be used. With a special-purpose computer, all details of the problem must be first defined and the mathematics involved in its solution worked out before the circuitry can be designed and built.

A general-purpose computer contains various amounts of basic computer circuitry, such as data storage, arithmetic, and logic units, which can be called upon to solve essentially any problem. Before being used for a specific purpose, the computer is programmed with sub-routines, or instructions, derived from solving the mathematics of the problem involved.

A single set of sub-routines is developed to adapt the general-purpose computer for numerical contouring. This same set is used for each computation for a different design of part. After once developing the sub-routines, they require further attention only when there is some basic change in the function of the system. The sub-routines usually are punched into cards or re-

Part of Programming Form Showing Data for Cut Along Broken Line in Fig. 2

Cut	Start		Finish		Arc Center		Surface	Tolerance	Left-Right	Cutter Diameter, Inches	Feed, Inches per Minute
	X	Y	X	Y	X	Y					
1	0	0	2.000	3.000			Line		R	1	100
2			3.000	3.000			Line				30
3			6.891	2.372	5.000	3.000	Arc	0.002			
4			7.775	4.700			Line				15
5			8.500	5.260	8.500	5.260	Arc	0.002			
6			11.000	5.260			Line				30

corded on magnetic tape, in which form they can be stored and fed into the computer, when needed, in only a few minutes.

Both types of computers have advantages. The special-purpose computer can be less complex because it is designed for one specific task, and therefore possibly requires less time for computation. It is, however, very inflexible. If a change is made in the type of computing required, the circuitry must be redesigned—an expensive and impractical procedure. At a time when numerical control is just being introduced as a manufacturing technique, it is believed that flexibility is particularly important. Since the functions performed by a general-purpose computer can be modified with relative ease, its use is preferred.

Size, too, merits consideration. Because of the increased speed with which large computers operate, their over-all cost of operation is relatively low. Since sub-routines can be changed in a matter of minutes, it is practical to use the computer only part of the time for machine-tool computing, and the remainder on other work. It therefore appears economical to use the largest computer that can be kept busy by the computing to be done at a given location.

Interpolation and Conversion—For curved surfaces, the computer provides data for a series of fairly closely spaced points along the path to be followed by the center of the tool. For straight cuts, it provides data on just the beginning and end of the tool path. The machine control, however, must continuously direct machine position. It needs information on the desired machine position in increments of 0.0005 inch or less, or at a rate of several hundred times per second. Thus, it is necessary to provide an interpolator to furnish data along the tool path between each data point supplied by the computer.

Also, in most cases, this information must be converted into a form acceptable to the machine-tool control. In some systems, interpolation and conversion are inherently one operation; in others, they are performed separately. Generally, they are made rapidly by electronic computing techniques, but one system uses an electromechanical means with voltage dividers and rotating contact devices. The reliability, and the reduction in size and cost offered by transistors and other new solid-state components will, it seems, favor the use of electronic techniques to the exclusion of any mechanical ones.

Machine Control—The output of the interpolator, or input to the machine control, is electrical information that tells each moving member of the machine when and how much it should move, or continuously tells it the position at which it should be. As shown in Fig. 3, the machine control also receives information of a similar character from each moving member, which tells the control where it actually is, or that the machine has actually moved when it was told to do so. This is position feedback. Thus, with the input information telling the control where the machine should be, and the feedback telling it where the machine actually is, the machine control recognizes any difference or error, and moves the machine to minimize the error. The machine control is also generally considered to include the power servos, which are the "muscles" that move and position the machine.

Current numerical contouring systems employ one of three basically different approaches to machine control. These may be called: (1) pulse-increment, (2) voltage analog, and (3) selsyn-phase.

In the pulse-increment system, the input information consists of a short pulse of voltage each time the machine should move a given increment, such as 0.0002 inch. The position feedback device connected to the machine provides a similar pulse each time the machine moves an equal in-

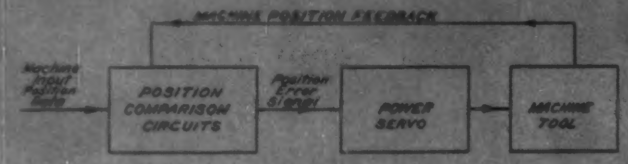


Fig. 3. Simplified schematic drawing of numerical machine control. Electrical equipment shown is duplicated for each machine feed.

crement. When the machine control receives an input pulse, it produces an error signal telling the power servo to move the machine. As the machine moves, it produces a feedback pulse cancelling the error signal. If the machine must move continuously, the input pulses come in a steady stream, requiring, in turn, a steady stream of feedback pulses.

The position feedback device that produces an electrical pulse for each small increment of movement of the machine takes one of two forms. It can be a rotary device that is geared to the moving machine member through a precision rack and pinion, or in some cases, through power gearing; or it may be a linear device such as an optical grating that can be mounted solidly on the moving machine member, as a scale would be, and eliminate the need for the gearing. The latter is a factor in favor of the pulse-increment system because, at the present stage of development, the other two systems use only rotary devices and require gearing. The slight inaccuracy of this gearing contributes a small amount of error to the over-all system.

There are, however, a number of unfavorable factors associated with the pulse systems. The amount of electronic circuitry required in the machine control is considerably greater than that used in the other systems. This equipment must be located on the shop floor at the machine, and it is desirable to keep equipment, particularly at this location, as simple as possible. Further, since the feedback device simply provides a pulse each time the machine moves a small increment, there is nothing fundamental to the system that tells the control where the moving machine member actually is with respect to any reference point. It is not an absolute position system. This is a possible source of cumulative errors, should the control miss a pulse or receive an extraneous one.

In most cases, it is desirable to record the input information on magnetic tape and present it to the machine control in that form, in order to separate the machine control from the data-processing part of the system. When pulses are recorded on magnetic tape, there is a limitation on the practical density, or number of pulses recorded per inch of tape. An acceptable figure seems to be about 200 pulses per inch. If a reel of tape is required to run a reasonable length of time, its speed is limited. Fifteen inches per second seems to be an acceptable figure here. If each pulse represents a machine movement of 0.0002 inch, this places the feed rate limit at 0.6 inches per second ($200 \times 15 \times 0.0002$), or 36 inches per minute, which is too low for economical machining of light metals or for traverse speeds on practically all machine tools. Techniques for overcoming this problem are understood and can be applied, but they have not as yet been used, and will require much additional equipment and complication.

The voltage-analog system makes use of machine-control input data (Fig. 3) in the form of alternating-current voltage, the magnitude of which is proportional to the desired machine position with respect to a zero reference point. The position feedback device provides a similar voltage proportional to the actual machine position. This feedback voltage varies from zero to maximum as the machine moves from one end of its travel to the other. The control compares these input and feedback voltages, and moves the machine in the direction that will tend to reduce the difference to zero.

The voltage-analog system has the desirable feature of being an absolute position system. That is, the input signal is there at all times and, by its magnitude, indicates a specific position for the machine. If the control were shut down, the machine moved by hand, and the control re-energized, the machine would return to the initial position automatically. This absolute position feature has other advantages, among which is the fact that it makes it impossible for the machine control to accumulate errors.

There are a number of disadvantages to this system. It is not possible to record the machine-control input data on magnetic tape because the tape will not accurately reproduce the magnitude of voltage. Thus, the interpolator and the machine control must be combined and located with the machine tool. Also, it is a strictly analog sys-

tem—voltage is analogous to machine position. If 0.001-inch accuracy is specified and machine travel is 100 inches, an accuracy of 1 part in 100,000 is required, which is appreciably above the generally accepted figure for accuracy in analog systems.

In addition, the interpolation function is performed by electromechanical means, and there is almost certainly no way to convert this to use electronic digital techniques. Electronic techniques are potentially more reliable, and certainly more flexible—and for these reasons preferred by many.

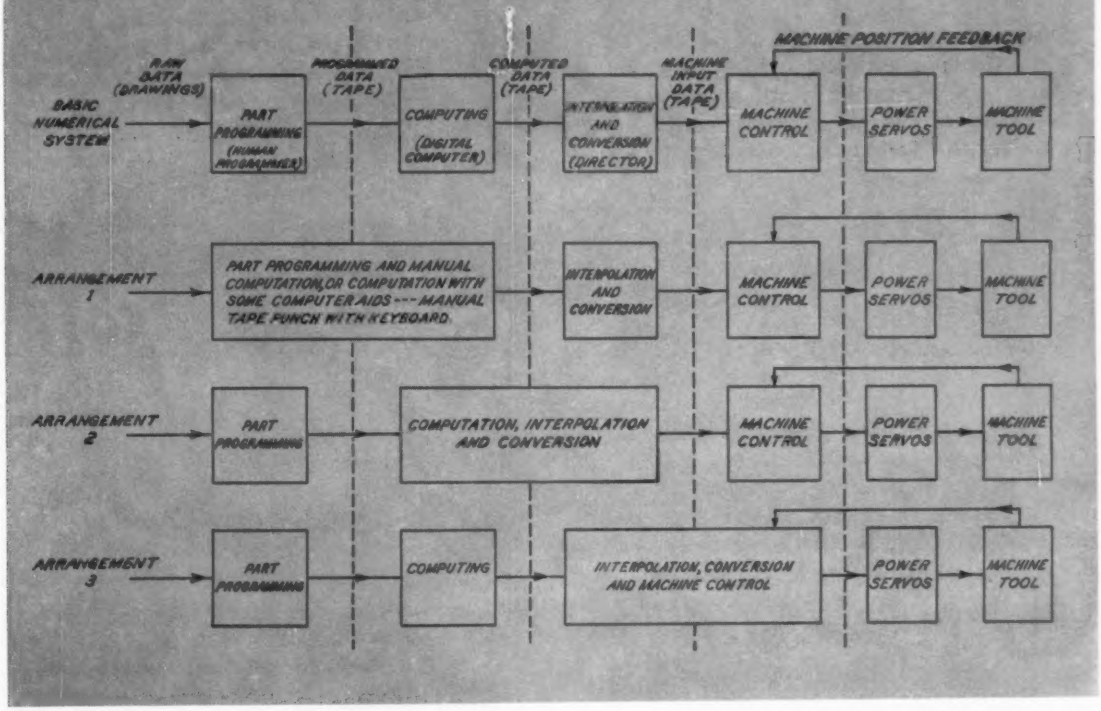
The selsyn-phase system makes use of machine-control input information in the form of an alternating-current signal, generally recorded on magnetic tape. The electrical phase of this voltage, with respect to a reference, is proportional to position. For position feedback, the system employs a rotary selsyn, or synchro, geared to the moving machine member through a precision rack and pinion. As used here, the output of the selsyn is alternating-current voltage with a phase that varies through 360 electrical degrees for each revolution of the selsyn. The phase of this position feedback signal is compared with the phase of the input signal, and the control serves to position the machine, when necessary, to keep the two signals in phase.

This system has some of the characteristics of each of the two described previously. It has the disadvantage that, in its present stage of development, the feedback device is rotary and must be geared to the machine through a rack and pinion. This gearing will introduce some small inaccuracies.

The selsyn is geared to revolve once for each 0.10-inch of machine movement. Since the voltage from the selsyn repeats itself for each revolution, this is not an absolute position system to the degree that the voltage analog system is, but it is absolute within this 0.10-inch increment. That is, once the machine is brought within the correct 0.10-inch band, it will automatically lock in at the exact position dictated by the input signal. It therefore cannot accumulate errors, and is easier to handle than the pulse-increment system because of its ability to automatically seek exact position after being only roughly positioned by the operator.

Because the absolute positioning characteristic is within a 0.10-inch increment, 0.001-inch accuracy requires a control system accuracy of only 1 part in 100, rather than 1 part in 100,000, as

Fig. 4. This chart shows how various functional blocks can be combined physically in an actual system.



required by the voltage-analog system. This accuracy is well within the capabilities of the control system.

The selsyn-phase system is satisfactory for using magnetic tape as the machine-control input, because the intelligence in the recorded information is in the timing of the signals (phase), rather than in magnitude. Information can therefore be accurately recorded and reproduced. Density of information is the equivalent of only about twenty-five pulses per inch of tape, regardless of machine feed rate, and therefore presents no limitation to operating speed, even for light metals.

The amount of circuitry required in the machine control is considerably less than that required for the pulse-increment system, and the interpolation and conversion function can be accomplished economically by electronic, computer type techniques.

Power Servos—The servos that actually power the feeds of the machine tool can be either all-electric, using direct-current, or, in small sizes, alternating-current motors, or they may be electrohydraulic, using either hydraulic rams or hydraulic motors. None of the systems demand any particular form of power servo, except that it must be suitable for electric control. It is extremely important, however, that the power servos have exceptionally good performance characteristics. Likewise, the dynamic characteristics and rigidity of the machine tool itself are required to be exceptionally good.

System Arrangements—Shown at the top of Fig. 4 is the basic approach to numerical contouring as described previously and shown in Fig. 1. Below that are several possible arrangements for combining the various functional parts. In numerical contouring, the physical arrangement is important because of its influence on the cost of the system and on the techniques selected for carrying out some individual functions. Conversely, the choice of techniques often dictates the physical arrangement.

Although numerical contouring systems using all of the different physical arrangements shown in Fig. 4. have been developed, it appears that something significant is lost whenever any two of the basic functional blocks are combined in a single physical package. Combining programming and computing, as shown in Arrangement 1, for example, requires that essentially manual, rather than automatic, computing be used, but in all but the very simplest cases, fully automatic computing provides tremendous advantages for the user.

If computing and interpolating are combined, as shown in Arrangement 2, it rules out the use of a general-purpose computer because, in most cases, it will be impractical for a general-purpose computer to provide the necessary interpolating. It means that an expensive special-purpose computer-interpolator is required. If computing and interpolating are separated, a general-purpose computer can be used economically, and the programming sub-routines that direct its operation can be modified from time to time to keep the computing abreast of developing needs.

The interpolating function can be incorporated as a part of the machine control, as shown in Arrangement 3. This arrangement has some advantages when the machine control uses the pulse-increment system, but it also has a number of disadvantages with any machine-control system, and these should be considered.

If interpolation is a separate operation, it needs to be done only once for each type of part to be produced, and it can be accomplished at five to ten times the speed of machining. A separate interpolator can therefore serve many machine tools. This means that, where several machine tools are required at one location, the installed cost and the amount of complex equipment should be less when a separate interpolator is used.

The separate interpolator can be installed away from the shop area, where it has better environmental conditions and can be given better maintenance, and where interpolating errors can be caught before they result in scraped parts. Obviously, there are instances where particular conditions overshadow these factors, but it is believed that in the majority of cases it will be best to retain physical separation of the individual functions, using paper or magnetic tape storage between them.

Based upon these considerations, it appears that the company that uses numerical contouring most efficiently will have a fairly large general-purpose computer (that can be used for other computing purposes as well as numerical contouring); a special-purpose director, or interpolator, to produce magnetic tapes for machine control; and a number of machine tools equipped to operate from these magnetic tapes. It will also have made a thorough study of its machining requirements, modified its design and manufacturing procedures where necessary, and developed personnel capable of using this new equipment effectively. The degree to which this is carried depends, of course, upon the volume of parts to be produced. Where the volume is small, simplifications can be made. But regardless of total volume, where complex machined parts must be produced, numerical contouring offers tremendous potential advantages.

MODERN HORSE AND BUGGY HARNESS

Stainless-Steel Collector Ring for Exhaust Gas Thermocouples

AN assembly of stainless-steel tubing and fittings forms a harness for thermocouples which measure jet-engine exhaust temperature. The harness acts as a collector ring and can handle any number of thermocouples required on the engine tail-cone. When the harness is installed on the engine and the engine is fired up, an electromagnetic force is generated and recorded on a millivoltmeter. This meter is calibrated to register directly in degrees of Fahrenheit.

Airtron, Inc., Linden, N. J., is the fabricator of the assembly. Production is exacting, since the harness must withstand temperatures between 600 and 1000 degrees F., as well as vibration, engine shock, and corrosion from the atmosphere and fuel.

The tubing (supplied by Carpenter Steel's Alloy Tube Division) is Type 430 welded stainless steel, and has a 1-inch outside diameter and a 0.035-inch wall thickness. Main purpose of the tubing is to provide a conduit for the two thermocouple wires (Alumel and Chromel). While the tubing material is considered best for the service conditions involved, it also has proved easy to work with in silver-soldering the fittings.

Each harness is composed of two half-circles of the tubing. They are made in diameters from 12 to 36 inches. Incoming tubing is inspected to a dimensional accuracy of 0.003 inch, then issued for production. It is first bent in an electrically operated jig around a table of appropriate diameter, as can be seen in Fig. 1.

No mandrel is used on the inside of the tubing. Rollers on a rotating arm squeeze the tubing against the concave rim of the table. While a clamp holds one end in place, the arm rotates halfway around the table, bending the tubing slightly

Fig. 1. The jig bends the tubing, then reverses automatically when rotating arm reaches end of work.

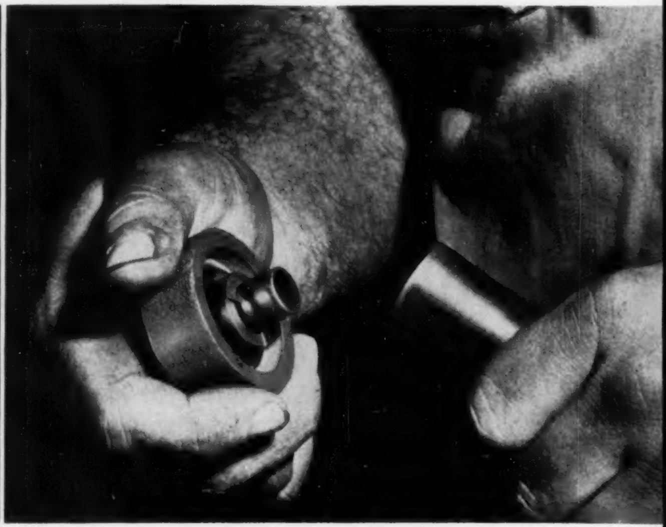


Fig. 2. When the tool is inserted in the tubing, a nut is tightened and the ends are flared 1/32 inch.

more than 180 degrees. The jig is pre-set to stop automatically at the end of the tubing, then return to starting position.

After bending, about 6 inches of material is taken off each end on an abrasive cut-off saw, leaving a completed half-circle. Both ends are then deburred—the outside on a flapper wheel, and the inside with a flexible-shaft grinder. To meet the inside dimension of mating parts, the ends must be expanded about 1/32 inch. This is done with a small flaring tool, Fig. 2. The tool is inserted in the tubing, and a nut on the top of the tool is tightened with a wrench.

A threaded ferrule is next silver-soldered to each end. These ferrules hold couplings which join the half-circles. After a solder ring is snapped inside the ferrule, heat is applied.

When a ring has been assembled, it is positioned in a Bridgeport milling machine. A series of 11/16-inch holes (nine to sixteen holes, depending on the size of the harness) are drilled through one wall to receive threaded outlets for the thermocouples. The holes are at a 6-degree angle. To avoid deflection, the drilling is done with a two-lipped end-mill, as can be seen in Fig. 3. During the operation, the ring is supported between a series of split blocks which are spaced around a rotary table. Toggle clamps open and close the blocks rapidly, and the table is indexed accurately to each hole location.

The outlets, Type 416 stainless steel, are prepared by being sanded on a drill press and tinned with solder. For the silver soldering, the fixture seen in Fig. 4 is used. After surfaces are fluxed, an outlet is placed in one of the holes. An arm constructed as a C-clamp secures the fitting to the ring during soldering. The ring is indexed beneath the clamp until all outlets have been soldered.

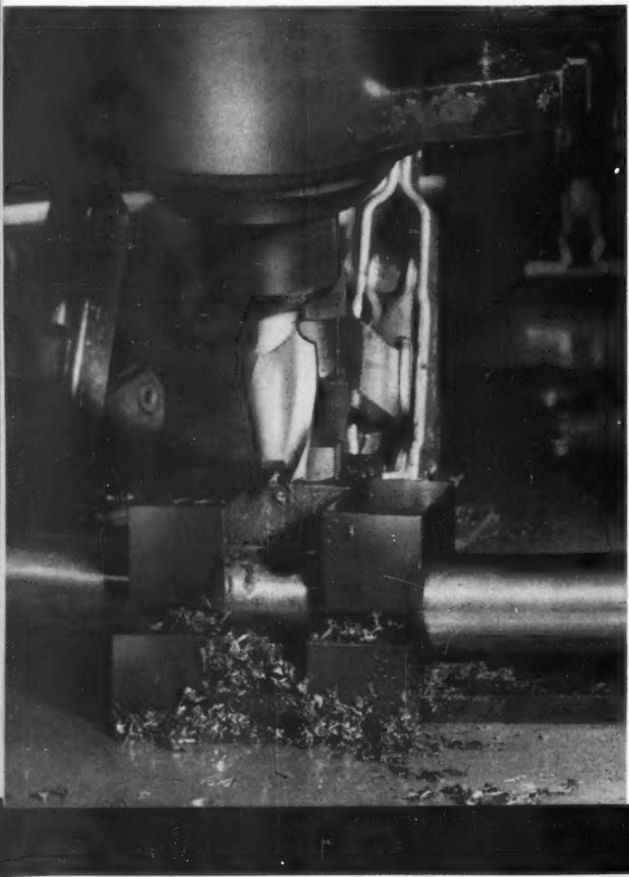


Fig. 3. An end-mill is used to cut a hole through one wall of the tubing. Here, an end-mill is more effective than a twist drill, since it will not deflect.

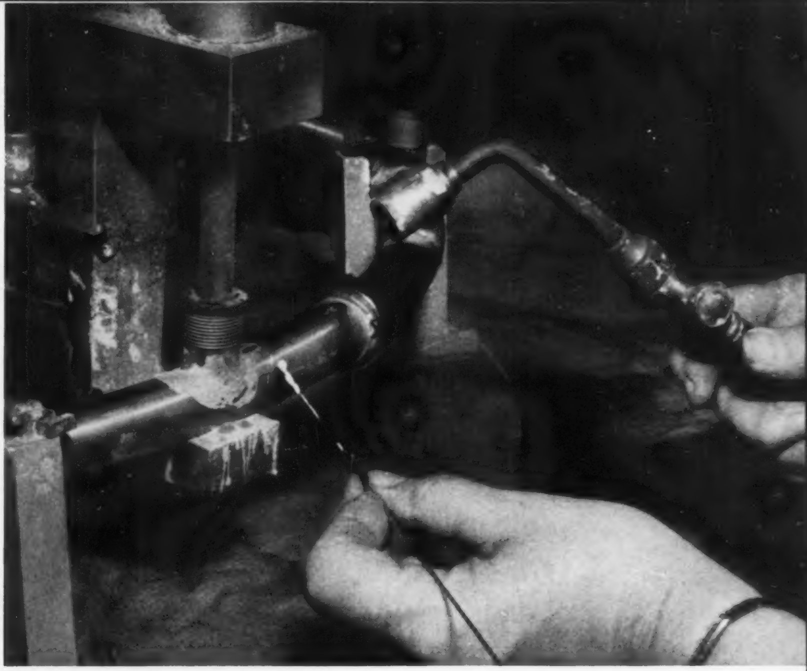


Fig. 4. A fixture with an arm constructed as a C-clamp secures the outlet to the ring during the silver-soldering operation.

After the flux has been cleaned off the joints, the harness is sand-blasted for plating. Each assembly is inspected thoroughly. Outlet threads are checked with "Go"–"Not-Go" gages, as shown on the title page, and a torque wrench is used on the outlets to test the strength of the soldered joints.

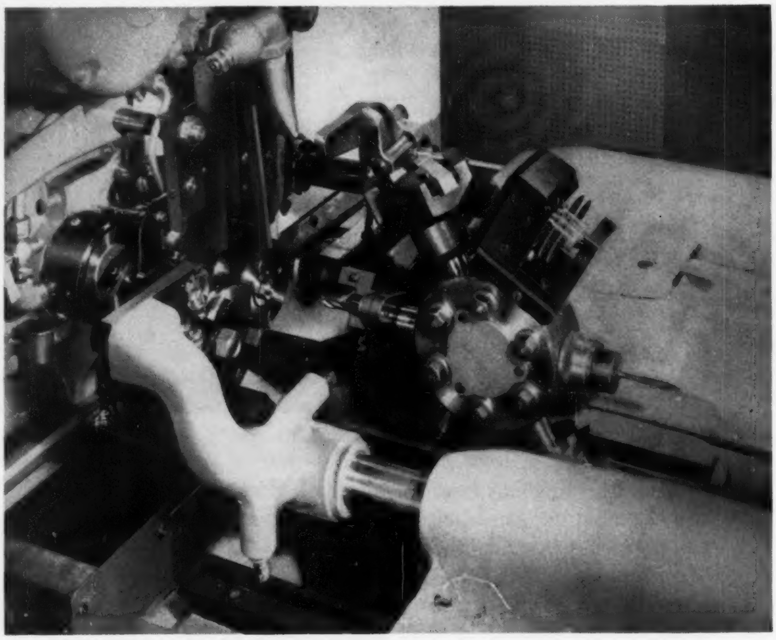
The Alumel and Chromel wires, both 0.162 inch in diameter, are bent to a circle in a jig. After being sheathed in fiber glass, the wires are run through ceramic spacers which are placed at varying intervals around the loop. At each thermocouple outlet location, special tees are soldered to the wires.

Inserting the wires in the ring, Fig. 5, requires a high degree of dexterity, to keep the tees in proper position as the wire is passed through each half-circle. Ends of the wires are joined and soldered in sleeve adapters, and couplings are screwed onto the ferrules, permanently joining the completed harness. Then, through the outlets, one Alumel and one Chromel pin are screwed into each tee. Two ceramic insulators are placed on top to hold the pins in place. A stainless-steel snap-ring is added to support the insulators.

The completed assembly is polished by hand and given a light plastic coating as an extra protection against tarnishing. Before shipment, it is given a thorough electrical check for performance and put through simulated humidity conditions. Each harness is exposed to 95 per cent humidity at 90 degrees F. for four hours, then brought to room temperature and tested for resistance to ground. This must be greater than 2 megohms.

Fig. 5. There is a tee on each wire at each outlet. In assembling harness, tees must line up with outlets.

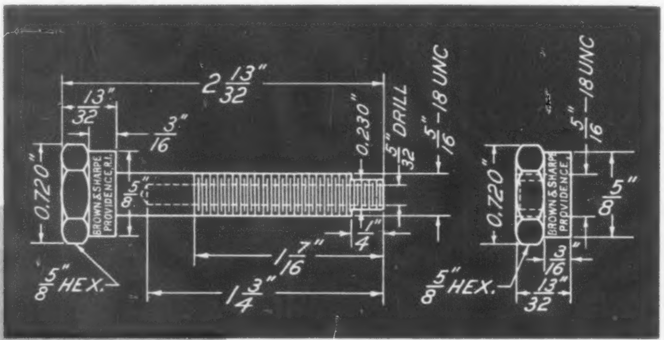
Mating Parts Made in Thirty-Second Cycle on Automatic Screw Machine



TO illustrate the versatility and productive capability of its new No. 2 automatic screw machine, the Brown & Sharpe Mfg. Co., Providence, R. I., tooled up one of the machines to produce a bolt and mating nut in a thirty-second cycle. The parts, seen in Fig. 1, are made from 5/8-inch hexagonal, brass bar stock. A hole, 5/32 inch in diameter by 1 3/4 inches deep, is drilled axially into the 2 13/32-inch long bolt to demonstrate a unique rapid pull-out mechanism in the machine turret.

A spindle speed of 5050 rpm is used on the 3/4-inch capacity machine for all operations except threading, for which the speed is decreased to 1885 rpm. The nut is produced first with the hexagonal bar stock being fed against a stop mounted on the machine turret, as seen at the top in the schematic tool layout, Fig. 2. When the turret has been indexed (in the standard time of one-half second), the nut is drilled and chamfered by tools mounted on the turret. The high-speed steel drill is fed at a starting rate of 0.003 inch per revolution. Then, the drill and the high-speed steel chamfering tool are accelerated to a feed rate of 0.01 inch per revolution.

Simultaneously, the nut is externally formed by a circular tool on the front slide. The feed of this tool is progressively decreased from 0.003 to 0.0015 inch per revolution during forming. When the forming, drilling, and chamfering tools have been retracted from the work, identifying



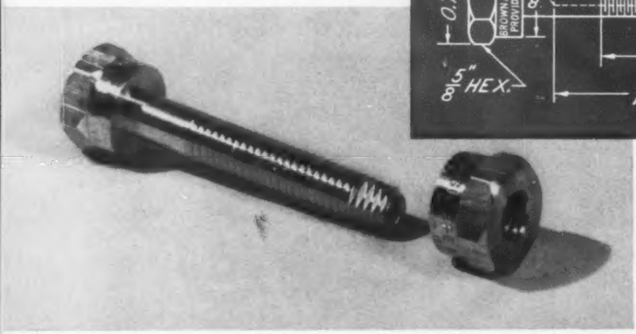
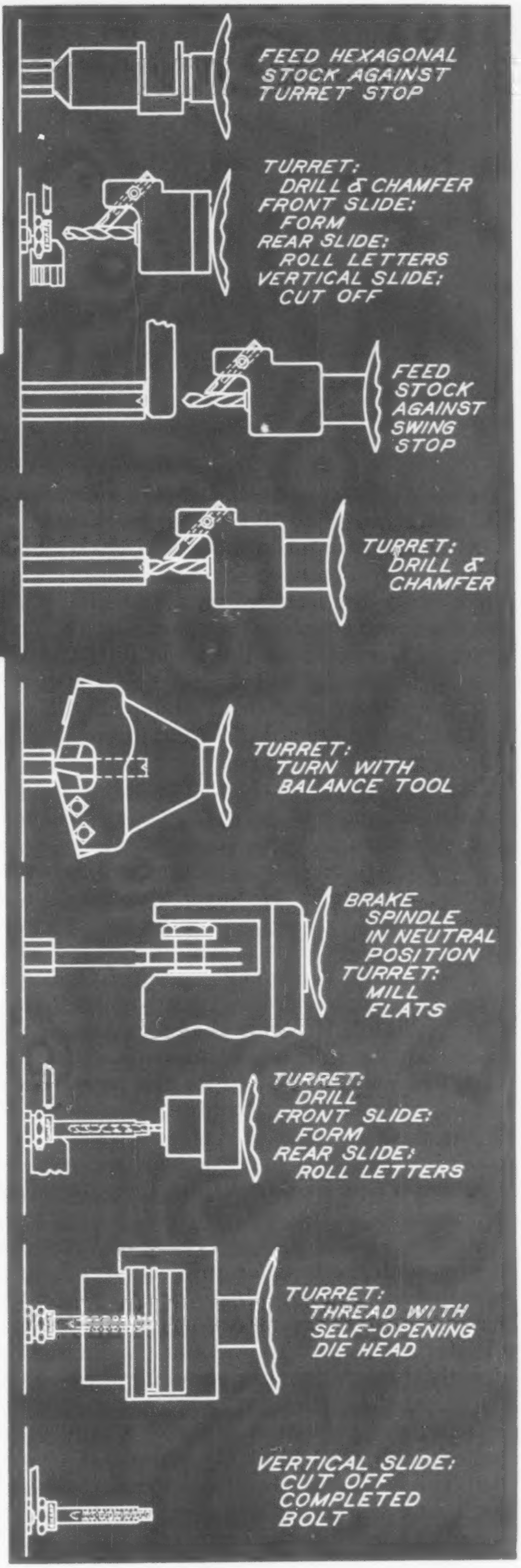


Fig. 1. Bolt and mating nut produced in thirty-second cycle on the automatic screw machine seen in the heading illustration.



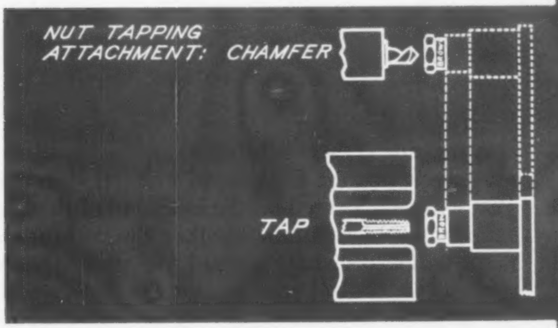


Fig. 2. Schematic layout of tooling used to produce bolt and mating nut in same automatic cycle. Nut is produced first, with the part being drilled, chamfered, formed, lettered, and cut-off as seen at the right. Then the nut is transferred to an attachment (shown below) for chamfering and tapping.

letters are impressed into the necked-down portion of the nut periphery by a marking roll mounted on the back slide of the screw machine.

As the nut blank is cut off from the bar stock by a tool mounted on the vertical slide, it is picked up by a pivoted transfer arm. First, the cut-off end of the nut blank is chamfered by a drill mounted in an intermediate spindle on a nut tapping attachment. Then, the nut is transferred to the tapping station and is picked up by a revolving sleeve which rotates it over a floating, bent shank, tapper tap. Tapped nuts are pushed along the shank, around the curved end, and ejected from an opening in the side of the attachment. Here they fall into a chute leading to a work pan. The tap does not rotate, and is supported only by the column of nuts passing through the attachment. In passing along the tap shank, the nuts bear on two bushings. Movements of the transfer arm are controlled by two cams located on the machine camshaft. The chamfering spindle as well as the rotating sleeve around the tap are driven by the attachment motor.

Meanwhile, the hexagonal bar stock is again fed outward, this time against a swing stop. The end of the bar is center-drilled and chamfered by tools mounted on the turret. When the turret is again indexed, the shank of the bolt is turned by means of a balance turning tool consisting of two single-point tools set in the holder to cut on opposite sides of the work. The shank of the box-

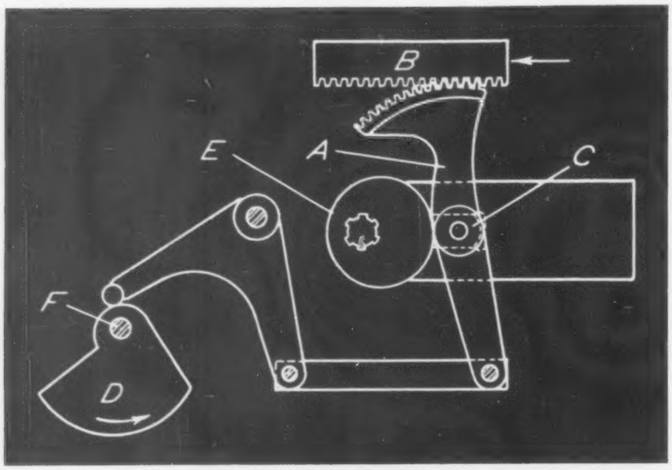


Fig. 3. Details of the rapid pull-out arrangement on an automatic screw machine for withdrawing drill to clear chips and lubricate point.

like body is fastened in a hole in the turret and is fed at the rate of 0.010 inch per revolution.

After the next turret index, the work-spindle is stopped by a brake-in-neutral arrangement, using a brake disc mounted on the spindle. When the two-speed clutch on the spindle is in neutral, pressure is exerted on the brake disc, and the spindle is brought to rest and held stationary. A turret milling attachment equipped with two cutters (seen on top of the turret in the heading illustration) is used to cut two flats on the end of the stationary bolt blank. The cutters are rotated at 865 rpm and fed at the rate of 0.012 inch per revolution.

When the turret is again indexed and the work-spindle restarted, a 5/32-inch diameter hole is drilled axially to a depth of 1 3/4 inches in the bolt blank. The drill is rotated at 3880 rpm, and combined with the spindle speed of 5050 rpm gives an effective drilling speed of 8930 rpm. The feed is 0.010 inch per revolution. During this operation, the drill is withdrawn four times to clear the chips and lubricate the point. Withdrawal and re-entry of the drill is accomplished in the standard index time of only one-half second by means of a rapid pull-out arrangement that uses a new lead mechanism incorporated in the machine.

As shown in Fig. 3, gear-segment arm *A*, which meshes with the teeth on turret-slide rack *B*, is mounted on a sliding pivot block *C*. When the turret-mounted tools are cutting, this pivot block remains stationary, and motion is transmitted directly through linkage from the lead cam *D* to the turret-slide. However, when a turret index or rapid tool pull-out is required, a cam *E* (in contact with pivot block *C*) makes one revolution. This causes the pivot block to slide back and forth, and withdraws and advances the turret-slide in a one-half-second cycle.

A trip-dog is used to initiate the one-revolution movement of cam *E*. A rapid pull-out disc cam (not shown), located on the back end of the lead camshaft *F*, determines whether the withdrawal is for indexing or only a rapid tool pull-out. The rise on this control cam de-clutches the drive to the turret-slide index crank, and no index occurs. A drop on the cam re-establishes the drive, and a normal withdrawal and turret indexing will occur together.

During drilling, the head of the bolt is formed by the circular tool mounted on the front slide, and identification letters are impressed into the head. The circular form tool and marking roll are the same used for the nuts.

As the turret is again indexed, the work speed is reduced to 1885 rpm for threading the bolt. Threading is done by a self-opening die-head held stationary in the turret by its shank. After bringing the work speed back to normal, the bolt is cut off from the bar stock by the tool mounted on the vertical slide. Then the machine repeats the automatic cycle.

Another unique feature of this new automatic screw machine is the provision of a positive stopping arrangement as standard equipment. A nylon roll presses against the bar stock at the end of the feed tube. When the bar end enters this tube, the roll drops down and starts a counting device. When the preset number of pieces have been produced, the machine stops and a signal light goes on.

• • •

The U. S. Bureau of Standards has obtained good results with a high-pressure packing of Teflon impregnated with 5 per cent, by weight, of molybdenum disulphide. This material has proved effective at pressures approaching 200,000 psi.

Splines Formed Ten Times Faster by Cold-Rolling

Propeller shafts for Evinrude outboard motors are made from AISI Type 410 stainless steel. Production has been increased and manufacturing costs lowered by cold-forming splines in the hardened and ground shafts.

By MILES ETZEL, Industrial Engineer, and
C. E. KOPP, Works Manager
Evinrude Motors, Milwaukee, Wis.

RECORD sales of outboard motors and the bright prospect of increased demands in the future have led Evinrude Motors to expand manufacturing facilities and improve production techniques. Many cost-cutting machine tools have been installed recently in the company's Milwaukee, Wis., plants, and several manufacturing methods have been changed.

One outstanding example of improved processing is the cold-forming of splines on propeller shafts for the outboard motors. This "chipless machining" method is ten or more times faster. In addition to the benefits of increased production, manufacturing costs have been substantially reduced. Also, accurate splines having a smooth surface finish and high strength are produced.

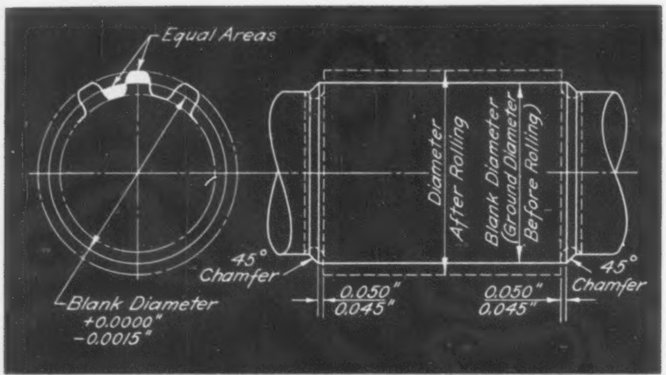
Spline-rolling is performed on the Roto-Flo machine seen in the heading illustration, which is made by the Michigan Tool Co., Detroit, Mich. With the shaft held between centers, reciprocating forming racks displace metal on the periphery of the part to form the required splines. Forming takes place in a matter of seconds, in one continuous operation.

The machine consists basically of the two rack type forming tools, two slides, and a C-shaped frame. Each slide, located one above the other, provides a mounting for one forming rack. Synchronization of the relative movement between the forming tools is maintained through a connecting gear that meshes with timing racks. These racks are an integral part of the forming tools, and each is powered by separate hydraulic cylinders for both forward and return strokes.

Propeller shafts for the Evinrude outboard motors are made from AISI Type 410 stainless steel, and hardened to about 38 Rockwell C prior to spline-rolling. The section of the shaft periphery to be splined is ground prior to rolling to a predetermined diameter, plus 0.0000, minus 0.0015 inch. This so-called "blank diameter" must be such that the area of a single spline tooth above the blank circle equals the area between two adjacent teeth below the circle—as seen in Fig. 1. (The spline teeth shown in this drawing have been exaggerated to show this relationship.)

The table in Fig. 1 gives the blank diameters as well as finished dimensions after rolling for four sizes of propeller shafts. The one having a blank diameter of 0.9210 inch is provided with twenty-three spline teeth having a pressure angle of 45 degrees and a diametral pitch of 25.0909/48. Root diameter of the splines is 0.8770 inch, and the pitch diameter, 0.9167 inch. It should be noted that in every case the blank diameter is larger than the pitch diameters of the splines. While it is usually unnecessary to grind the spline peripheries after rolling, it is done in this instance because of a close fit required at assembly. For the shaft ground to a diameter of 0.9210 inch prior to rolling, this diameter is increased about 0.043 inch in producing the major diameter

Fig. 1. Diameter of developed blank must be such that the amount of metal displaced outward in rolling equals that moved inward.



Blank Diameter, (Ground Diameter Before Rolling), Inches	Spline Diameter After Rolling, Inches	Spline Diameter After Grinding, Inches
1.1280	1.1667	1.1512
0.6580	0.7034	0.6865
0.9210	0.9640	0.9470
0.7610	0.8077	0.7922

of the splines, and decreased 0.044 inch to shape the minor diameter, during roll-forming.

A slight redesign of the propeller shaft splines was made to permit the change-over to cold-forming. Originally, the splines had a 30-degree pressure angle with a minor diameter fit. Now, a 45-degree pressure angle, major diameter fit, and full fillets at the minor diameter are specified. These changes provided a considerably longer forming-rack life. In rolling, the splines tend to "drop-off" at their ends, and the specified full diameter cannot always be obtained in these areas. For this reason, a chamfer is provided at both ends of the blank surface to prevent metal from being pushed over the ends and to restrain endwise movement of the top of the teeth. Also, the developed blank is made longer than would ordinarily be required, and fillets are ground into the shaft at the ends of the splines after rolling.

The shaft to be rolled is manually loaded between centers, Fig. 2, with the outer end being clamped by an air-operated tailstock suspended from an over-arm on the front of the machine. Automatic loading and unloading devices can easily be adapted to the machine if required.

When the automatic cycle button is depressed, the forming tools begin their linear strokes toward each other, Fig. 3, thus rotating the shaft about its own axis on the centers. The rack type forming tools have a circular pitch corresponding to the blank diameter and are designed with tapered teeth to press successively deeper into the shaft as the forming action progresses. A few additional revolutions of the shaft are made at full rack tooth depth to obtain the specified ac-

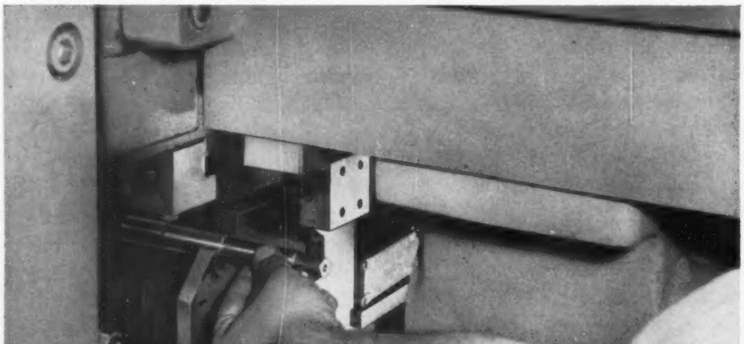
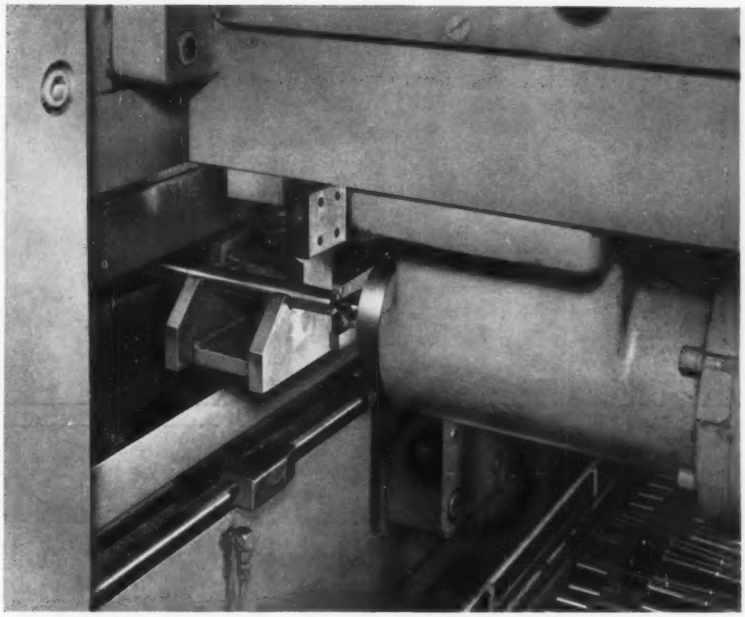


Fig. 2. Propeller shaft being manually loaded between centers in spline-rolling machine. The outer end is clamped by an air-operated tailstock.

Fig. 3. As rack type forming tools are fed toward each other, the shaft on which the splines are being formed is rolled about its own axis.



curacy and produce a smooth surface finish—about 6 micro-inches. High strength is developed due to pre-stressing and the rearrangement of the metal grain structure during cold-working. Tooth loads on the finished splines are normal to the direction of grain flow.

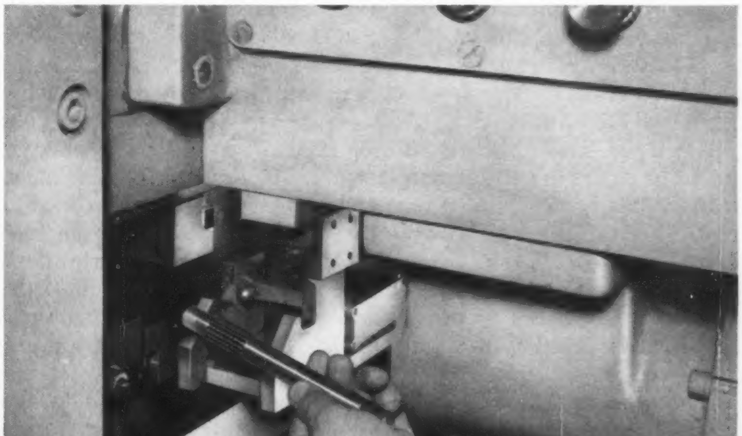
After the splines have been completely cold-formed, the tailstock is retracted, and the shaft is manually unloaded, Fig. 4. The tool racks are then returned to their starting positions. Electrical interlocks prevent the tools from returning until the shaft has been unloaded. Traverse of the 24-inch long rack takes only 5.4 seconds, and floor-to-floor time per shaft is about 20 seconds.

Forming racks are made of high-alloy steel with teeth ground on a special Michigan Tool machine to give a high degree of accuracy in form, spacing, and pressure angle. Since all loads on the tools are compressive and not in shear, good life is obtained. Approximately 30,000 propeller shafts can be rolled before the tools need resharpening, and each pair of forming racks can be ground about four times—giving a total life of 150,000 shafts.

The tool racks can be adjusted longitudinally on the slides to gain correct relationship with the shaft axis. Also, because of the tapered design of the tools and backup wedges, they can be adjusted toward or away from the work center.

A high-quality hydraulic oil having a viscosity of 150 S.S.U. at 100 degrees F. is used in the machine. The coolant is Roto-Lube, manufactured by the Shear-Speed Chemical Products Division of Michigan Tool Co.

Fig. 4. Shaft with cold-formed splines is manually unloaded before the racks are retracted. Machine is adaptable to automatic loading and unloading.



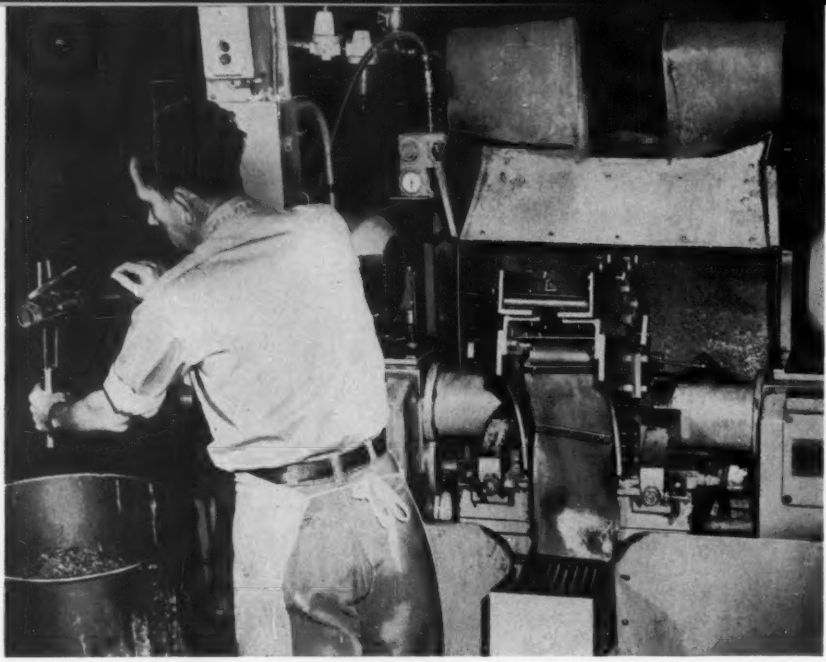


Fig. 1. Centering machine converted for double-end boring of short tubes. Chips which are directed into the tube to avoid tool troubles are later removed by pushing the parts over vertical rods (left).

Feeding Chips into Bores Minimizes Tool Wear

Fifteen hundred tubes are processed in an eight-hour shift by using carbide tools that have been especially ground to advance chips into the tube.

By J. William Stevenson
Whirlpool-Seeger Corporation
St. Joseph, Mich.

WASHING machines for home laundries are manufactured in the plant of the Whirlpool-Seeger Corporation, St. Joseph, Mich., at what is believed to be the highest rate in the world. To keep production facilities geared for this output, machine down time must necessarily be held at a minimum. Excessive down time encountered in boring tubular steel parts was overcome in a unique manner.

The tubes—made of SAE 1010 or 1020 steel—are 1 3/4 inches in outside diameter, 1 1/2 inches in inside diameter, and approximately 13 inches long. After the tubes are cut off, their periphery is ground to size. A double-end machine is used for boring, so that operations can be performed simultaneously on the opposite ends of each tube. Each end is bored to a depth of 1 7/8 inches, chamfered on the inside edge, rounded on the outside edge, and faced.

Although these operations are simple in themselves, difficulty was encountered in performing them at the desired speed while still holding the specified bore dimensions. Chips from ordinary boring tools tended to foul and dull tool edges. This slowed production since the tools had to be changed frequently. In boring, about 0.030 inch of metal is removed on a side for a 1 7/8-inch depth at each end, and therefore a comparatively large volume of chips are produced.

Two Seneca Falls Lo-swing double-end centering machines, one of which appears in Fig. 1, were modified for the job. Each is equipped with a magazine feed, to supply the indexing drum that carries the tubes into position for air-clamping. Tools then advance to machine both ends simultaneously as the tube remains locked in position. Figs. 2 and 3 show details of the setup. Jets of water-soluble coolant prevent overheating.

Except for loading of the magazine and removal of work-pieces from the discharge chute,

this setup is fully automatic. Initially, a high rate of production would have been attained if chips did not frequently cause tool trouble. The boring tools used then were ground to break the chips and feed them outward. Such tools soon become dull. As the down time was excessive, it was decided to try a boring tool that would not break the chip but would feed one continuously ahead of the tool and into the center of the tube rather than in the opposite direction.

The boring tool now used is ground as indicated in Fig. 4, the tool being made from a solid SC 1212 Grade K-6 Kennametal blank. This type of tool has produced excellent results. In some cases, as many as 1500 pieces have been produced without tool changes, but the average is 700 to 800 pieces. This means tool changes occur only about twice in an eight-hour shift, during which each machine produces about 1500 pieces. Hourly production, when operating, is 275 an hour for one size and 240 for the second size.

Tubes drop from the drum fixture, after being indexed to and from the working position. An operator then removes the parts from a discharge chute, two at a time. Each piece contains the boring chips, but these are easily knocked out into a barrel by two vertical rods supported on an arm. One rod enters each tube as the operator pushes the tubes upward. He then places the completed parts in a box. As the operator has ample time both for this chip-removal operation and for loading the magazine with new tubes, there is no delay in the machining cycle. There is the further advantage that only the fine, broken chips from secondary cuts fall below the work-piece. These involve no removal problems.

Other significant features also contribute to the success of the operation. Tubes roll down the magazine and drop, one at a time, into notches of the indexing drum at each indexing. In advancing toward the machining station, each part is pushed into the correct endwise position by locating plates.

When a tube is indexed into machining position, each end comes to rest between a pair of clamping jaws. Cams, timed in synchronism with the machine, control the valves that cause the jaws to open and close. Before closing, however, the jaws are blown free of chips by air jets, to insure proper location of the part. Upon closing, the jaws hold the tube independent of the drum. Micro switches are placed to stop the machine in the event that jaws do not close within 0.005 inch of the desired location.

Fig. 2. Close-up of drum-like indexing fixture which receives tubes mechanically from the magazine. After indexing to the machining station, both ends of each tube are automatically air-clamped.

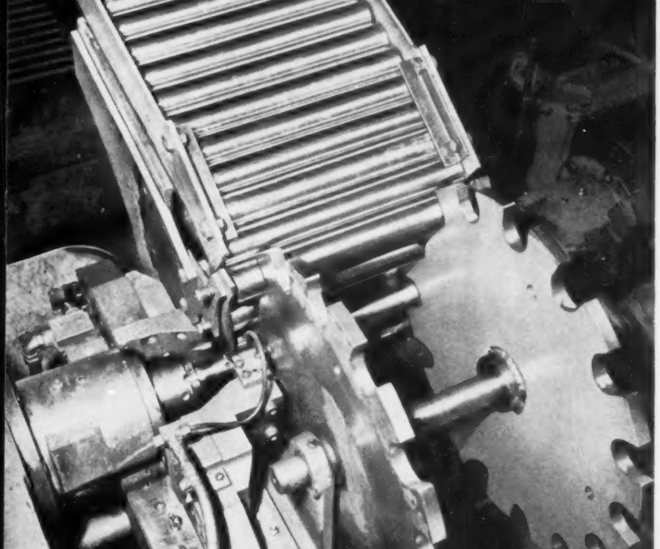
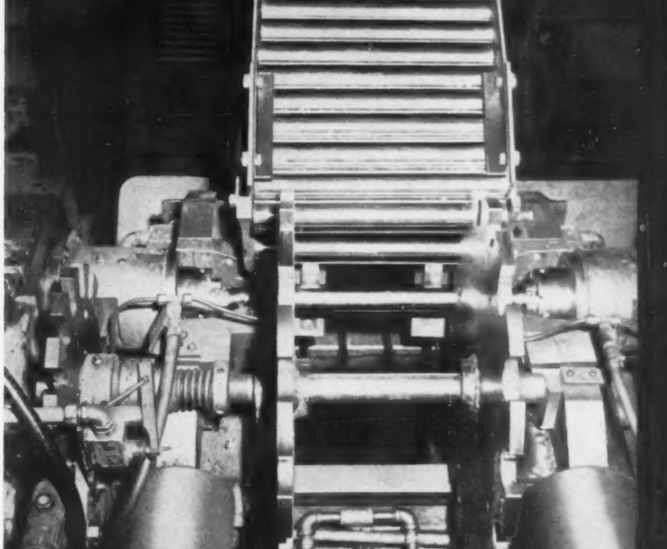


Fig. 3. Air-clamping jaws and their operating cylinders for both spindles of the double-ended machine as seen from the rear. In addition, air is employed to blow chips from the jaws before clamping.



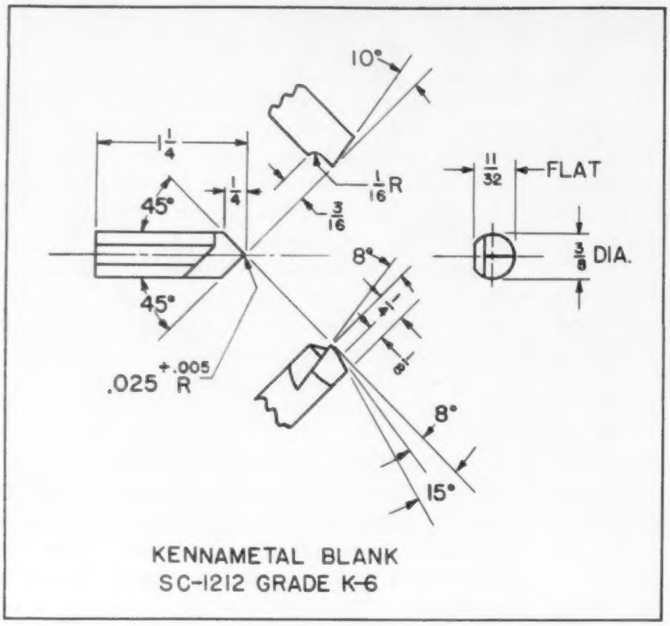
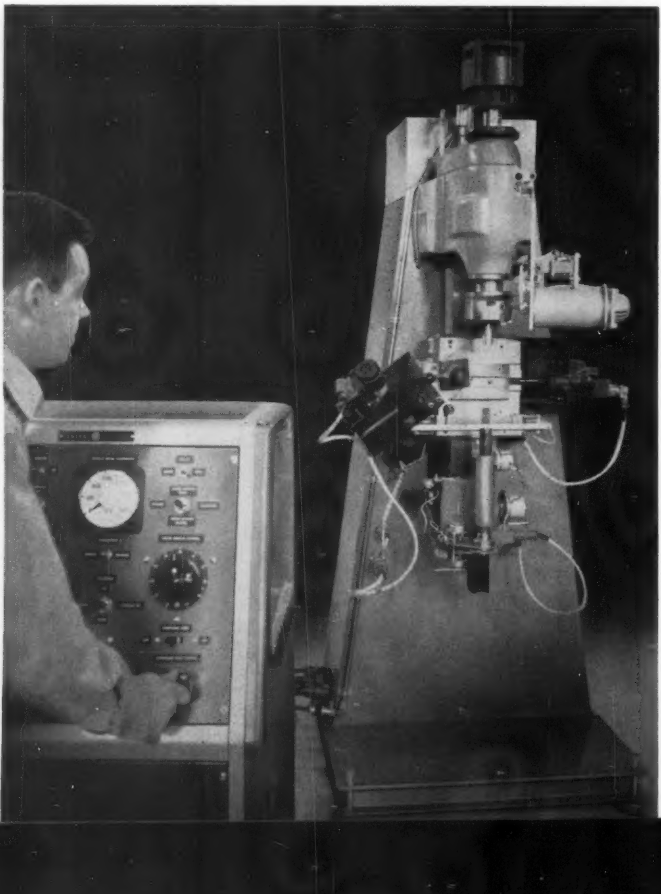


Fig. 4. Drawing of the Kennametal tool showing how it is ground to throw a continuous chip into the bore of the tube.

When clamping is completed, the tools carried by the rotating spindles of the machine feed in automatically from both ends. Boring tools advance first, and, when they are near the ends of their cuts, the chamfering tools and the edge-rounding and facing tools make their cuts.

As each tube is completed, the tools automatically retract, and the jaws open. This releases the work-piece, but leaves it in the notch of the indexing drum. At the next indexing station the tube drops into a chute and rolls to a point convenient for removal by the machine operator.



A new remote-positioning system for machining radioactive material is shown undergoing tests in a General Electric laboratory. Lear "Electrolink" systems have been installed on a modified, vertically mounted, Hardinge lathe so that all normal hand operations can be carried out from a distant station, with the operator shielded by lead or concrete walls. Remote-control units were installed on both the compound rest and the cross-slide, with a third unit on a milling attachment.

MATERIALS

The properties and new applications of materials used in the mechanical industries

Nonporous Crystalline Materials Made from Glass

A family of basic materials—harder than high-carbon steel, lighter than aluminum, and up to nine times stronger than plate glass—has been developed by Corning Glass Works, Corning, N. Y. Called Pyroceram, these materials are made by a process in which noncrystalline glass is turned into nonporous crystalline material that is harder than most ceramics and many metals. At present this material is used only for missile radomes—cones that protect the sensitive directional instruments in the nose of a missile from the sudden high temperatures experienced in hypersonic flight. The softening point of Pyroceram is 2460 degrees F.

Some of the physical and chemical properties of this material are given as follows: strength (flexural)—up to 40,000 psi, experimental types up to 60,000 psi; specific gravity—2.40 to 2.62; strength to weight ratio—14.1 (Pyroceram Code 8605); softening temperature—up to 1350 degrees C. (2462 degrees F.); porosity—gastight; color—white, opaque, or clear; structure—polycrystalline oxide; electrical properties—extremely low loss factor at high frequencies and high temperatures, and high dielectric constant at high frequencies; chemical stability—Pyroceram Code 8607 is nearly as resistant to acid attack as borosilicate glass and more resistant to alkali attack; thermal expansion—can range from slightly negative to 200×10^{-7} per degree C.; thermal conductivity—at 0.10 cgs units, Pyroceram Code 8605 has four times the conductivity of borosilicate glasses.

The materials have great flexibility and can be made into large and complex shapes by any of the known glass-forming techniques. Pyrocerams can be pressed, drawn, blown, rolled, and centrifugally cast. Certain types can be formed by investment casting techniques, such as those used in metal foundries. This enables them to be fashioned into complex close-tolerance parts.

Two steps in the manufacture of a missile radome made from Pyroceram—a material made from glass but nine times stronger than glass and harder than high-carbon steel. The radome on the left shows the material before heat-treatment, the radome on the right shows result of heat-treatment which induces crystal growth.

Stripper for Epon and Other Tough Finishes

A solvent-acid compound designed to strip high-grade epons and other tough finishes from all metals except magnesium has been announced by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. Called Oakite Stripper S-A, it strips tough finishes in about ten minutes and removes a wide variety of paints in from one to five minutes. The material is also said to remove light rust, scale, and smut deposits. It is used full strength at room temperatures and presents no fire hazards.

Riveted Aluminum Grating with Rectangular Openings

An aluminum grating that remains structurally rigid regardless of cutouts located in any part of the panel has been announced by the Klemp Metal Grating Corporation, 6601 S. Melvina, Chicago 38, Ill. Known as "Klemp Rectangular Riveted (RR) Aluminum Grating," its design eliminates the possibility of dirt, oil, or scum accumulating in corners. This material should prove useful for construction and maintenance in many industries.

Non-Soap Greases that Provide Chemical and Physical Stability

Greases with non-soap organic type thickness have been made available by Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill. The greases, known as Rykon, are especially useful in applications where extreme heat or excessive moisture may be present and maintain their consistency and structure under severe mechanical working conditions. The thickening agent used has a strong anti-oxidation effect on the grease and, when combined with the high-quality oils, it produces stable products. The greases have an ASTM dropping point of 480 degrees F. Rykon greases may be used in a wide temperature range, are resistant to oil separation, and exhibit rust preventive properties.

Applications include lubrication of electric motor bearings, pumps handling hot liquids, portable tool gear cases, steel mill roll bearings, exhaust fan bearings, and steam joints (rotary).

High-Strength Aluminum-Magnesium Alloy that is Ductile

An aluminum-magnesium base alloy that has high strength, ductility, dimensional stability, corrosion resistance, good anodizing characteristics, and is suitable for sand or permanent mold castings has been announced by Apex Smelting Co., 2537 W. Taylor St., Chicago Ill. The alloy, known as Apex 417, has an ultimate strength of 40,000 psi, a yield strength of 21,000 psi, an elongation of 13 per cent, a Brinell hardness of 70, and a solidification range of 1165 to 1020 degrees F.

The alloy—classified as a free-machining alloy —cuts without chatter or tool build-up. Tests have shown that Apex 417 can be machined at speeds up to 4000 surface feet per minute. The alloy has the following percentage chemical composition: copper, 0.10 max.; silicon, 0.15 max.; magnesium, 6.5 to 7.5; zinc, 0.05 max.; iron, 0.20 max.; manganese, 0.10 to 0.25; titanium, 0.10 to 0.25; and aluminum, the balance.

This aluminum-magnesium alloy has been used by aluminum foundries to make castings for the agricultural, aircraft, automotive, machine tool, and marine industries.

Vinyl-to-Metal Laminate Can Be Drawn, Bent, and Crimped

A vinyl-to-metal laminate that can be drawn, bent, or crimped without damage to the laminate has been announced by American Nickeloid Co., Peru, Ill. Called Laminol, this material consists of tough vinyl sheeting permanently adhered to a metal base of steel or aluminum. The vinyl is available in a variety of embossed surface textures and colors that are resistant to abrasion, impact, and staining.

It is expected that the product will be used for such items as television and radio cabinets, business machine housings, luggage, instrument panels, and wall coverings. It is available in sheets up to 32 inches by 144 inches and in coils up to 32 inches in width.

Solid Film Lubricant for High Operating Temperatures

A lubricant, designated Solid Film Lubricant No. 2006, has been developed by Electrofilm, Inc., P. O. Box 106, North Hollywood, Calif. Normally used at operating temperatures up to 800 degrees F., it may be used at up to 1000 degrees F. in applications such as in the prevention of galling and seizing of threaded parts and fasteners, as well as in control mechanisms for rocket and jet engines. Its coefficient of friction has been measured to be as low as 0.022 under high loads at 550 degrees F.

The lubricant is made up of silicones and high-temperature phenolics, combined with micro-fine particles of moly-disulphide and synthetic graphite. At present it is being used for several jet- and rocket-engine applications.

Hard-Facing Paste that Withstands Abrasion and Heat

A hard-facing paste that creates a deposit of high hardness enabling metal surfaces to withstand extreme conditions of abrasion and heat has been announced by Western Carbide Corporation, 6840 Vineland Ave., North Hollywood, Calif. "Hi-C 60," as it is called, can be applied to any metal with a melting point higher than the paste (1850 degrees F.). Thicknesses up to 1/4 inch can normally be hard-faced, using gas heating. For thicknesses greater than 1/4 inch, induction heating is recommended.

The paste is a permanent suspension of powdered hard-facing alloy in a water-base solution that can be applied by spatula, brush, or by extrusion from a tube. Hardnesses obtainable range from 55 to 61 on the Rockwell C scale.

Easily Removable Masking Tape for Use at Elevated Temperatures

An easily removable masking tape with good resistance to adhesive transfer for elevated temperature use has been announced by the Minnesota Mining & Mfg. Co., Dept. L7-132, St. Paul, Minn. Designated "Scotch" brand masking tape No. 214 (Type 2MNB), it can be used at temperatures up to 300 degrees F. for as long as eight hours and will withstand temperatures of 400 degrees F. for shorter periods.

The tape has a crepe paper backing and a good pressure-sensitive adhesive. It can be used to mask treated as well as plain metal surfaces. The tape has a tensile strength of 20 pounds per inch of width, an elongation of 9 per cent, and will withstand loads up to 25 ounces per inch of width when adhering to steel. It is available in standard roll lengths of 60 yards in any width and is 0.008 inch thick.

Chemical- and Heat-Resistant Coating Available in Many Colors

A paint coating that is compounded in many colors including white has been made available by the Wilbur & Williams Co. 130 Lincoln St., Boston 35, Mass. The coating, designated Rubber-Coat Liquid Hypalon, also is weather resistant, ozone resistant, and flame resistant and remains flexible at low temperatures. It is intended for use in a temperature range of from −40 degrees F. to +350 degrees F. The coating, which may be brushed or sprayed, is being used for the identification of pipes, tanks, refineries, and chemical equipment.

Liquid Detergent for Industrial Cleaning and Sanitizing

A concentrated liquid detergent, Oakite Liqui-Det, has been announced by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. This detergent is said to go into solution quickly and to develop copious suds in hard or soft water, hot or cold, and then to penetrate and loosen the most common soils in a very short time. It can be used repeatedly on an item without rinsing and will not cause build-up of film or discoloration.

Engineers of the Ford Motor Co., together with engineers of the McCord Corporation and the Allegheny Ludlum Steel Corporation, have come up with a solution to the cooling of automatic transmission oils by developing the Type 430 high-chromium stainless steel heat exchanger shown (whole and in section) below the radiator. Stainless steel was used since it is resistant to corrosion at elevated temperatures, highly ductile, and economical.

Maintaining Lamination Dies

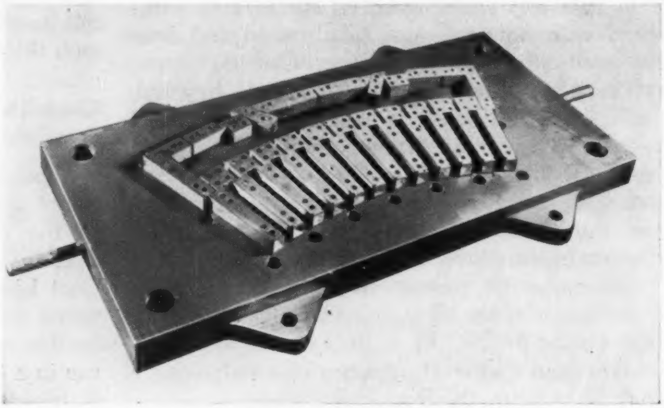


Fig. 1. Lower half of a die used for cutting lamination segments for a large generator. In sharpening, the die is ground to a mirror finish.

PERIODIC sharpening of lamination dies by surface grinding is one of the major phases of tool maintenance. Because there is a variation in grinding characteristics between different die steels, it is important to obtain all available information from the producers concerning their particular material. It is equally important to contact the abrasive-wheel manufacturer for data regarding the best wheel to use on given steels, and also for any information available on recommended grinding techniques.

At a midwestern plant engaged in the manufacture of power generators, power distributors, and other equipment for power utilization, proper maintenance of costly lamination dies is of prime consideration. An example of this can be seen in Fig. 1, depicting the lower half of a stator combination die measuring 18 inches wide, 42 inches long, and 6 inches high. The material is Neor die steel—a high-carbon, high-chromium, oil-hardening type steel that bears the SAE designation D3.

Peripheral grinding on horizontal-spindle machines, such as the Mattison grinding machine shown in Fig. 2, is particularly suitable for die steels that are more than ordinarily heat sensitive. Grinding speed should be carefully selected. In the illustrated operation, a 38A36-K8VBE straight wheel, 18 inches in diameter with a 6-inch wide face, is being used. It is run at 1200 rpm, with a depth of grind of 0.0005 inch. Parallelism is held within 0.005 inch. The coolant used consists of one part soda ash mixed with five parts water. One man, with the aid of a chain hoist, can load the die on the machine and position it on the magnetic chuck.

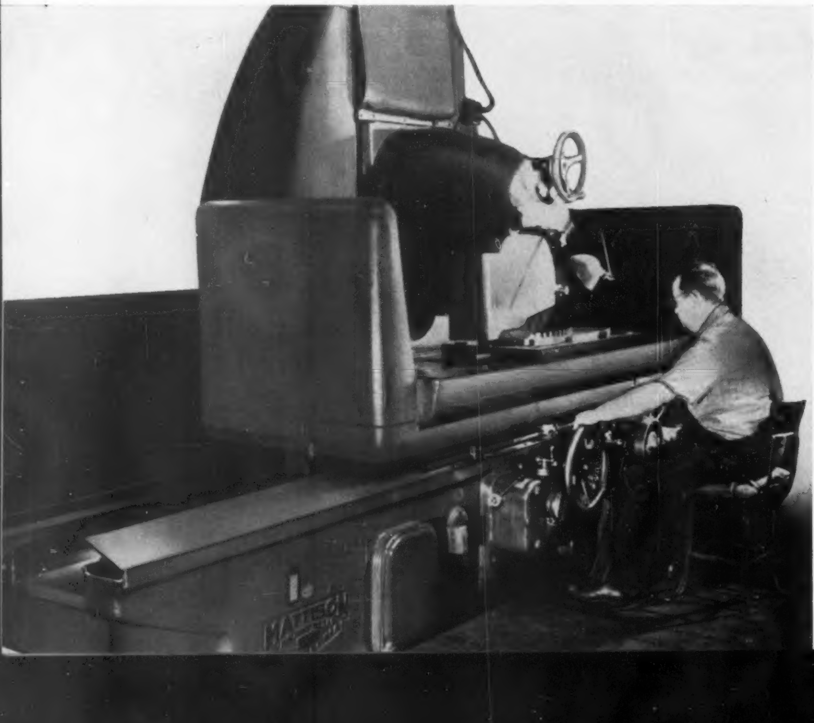
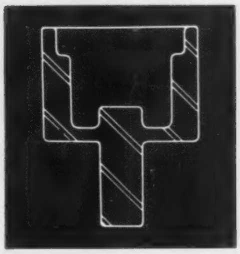
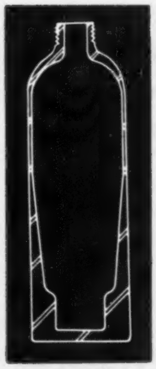


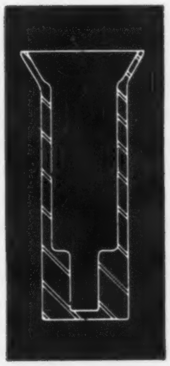
Fig. 2. Horizontal - spindle grinding machine being used to sharpen a lamination die. The wheel has an 18-inch diameter and a 6-inch face.

MACHINERY'S *Reference Section*

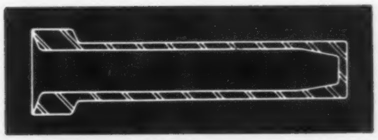


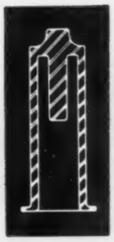
Cold Extrusion of Steel





By BEN KAUL





August 1957

Suppose you need large lots of a heavy-walled steel cylinder that has to withstand a severe bursting pressure. You find you can't get the needed properties from a casting. . . . Hot forging? Not quick enough, when machining time is figured in. . . . Bore the cylinder from solid bar stock? Impractical for high production. . . . Use seamless tubing and fit a cap on one end? Too risky because of the extreme pressures involved. Stymied by limitations in conventional processes, you latch on to cold extrusion.

COLD EXTRUSION OF STEEL

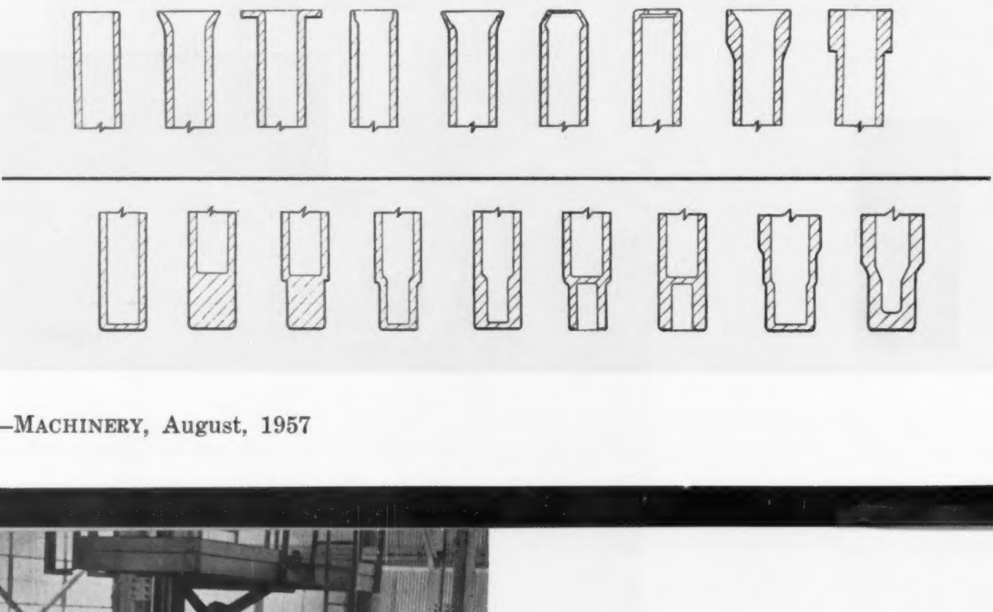
By BEN KAUL
Technical Research Director

Youngstown Kitchens Division
American-Standard
Warren, Ohio

ONE of this decade's significant new metal-working processes is the cold extrusion of hollow steel cylinders having integral bottoms. These parts start life as slugs cut from bar stock. Then, by forcing the metal to flow in dies at room temperature, the slugs are gradually transformed to the finished product.

Except that the weight of slug and cylinder are identical, the two have little else in common: the stubby slug has become a slender, hollow cylinder. Replacing the rough mill surface is a finish on the order of 40 to 60 micro-inches—and this, without any machining. Geometry has been corrected, from an out-of-round condition (a par-

Fig. 1. A few of the variations possible in the shape of a cold-extruded cylinder. The upper row shows variations in the cylinder top; the lower row, in the bottom.



ticular characteristic of a slug from a hot-rolled bar) to a concentricity within plus or minus 0.0005 inch, per inch of diameter. And because the metal is always pushed, never pulled apart, physical properties improve to the point where a low-carbon steel cylinder exhibits the tensile strength and yield strength of a high-alloy cylinder produced by some other method.

The development of this process of steel extrusion—Koldflo—began ten years ago at the Mullins Mfg. Corporation, Warren, Ohio. This company (now the Youngstown Kitchens Division, American Radiator & Standard Sanitary Corporation) directed its earliest efforts to the successful production of 105-millimeter shells for the United States Army's field artillery. (See MACHINERY, January, 1951, pages 158 to 163.) The process was successful from the start, and the company has since become a major supplier of these shells. In addition, many nonmilitary items are being cold-extruded today.

Some of the variations possible in the design of a cold-extruded steel cylinder appear in Fig. 1. Those in the upper row show variations in the cylinder top; those in the lower row, in the cylinder bottom. The outside of the cylinder can be straight, or it can have a flare, flange, or shoulder at the top, and a reduced diameter, clevis, or stud at the bottom. Likewise, the inside can be straight, stepped, or tapered. Neither the periphery nor the bore need be circular in cross-section. Either or both can be square, hexagonal, or some other shape. Corners can be left square or provided with a fillet.

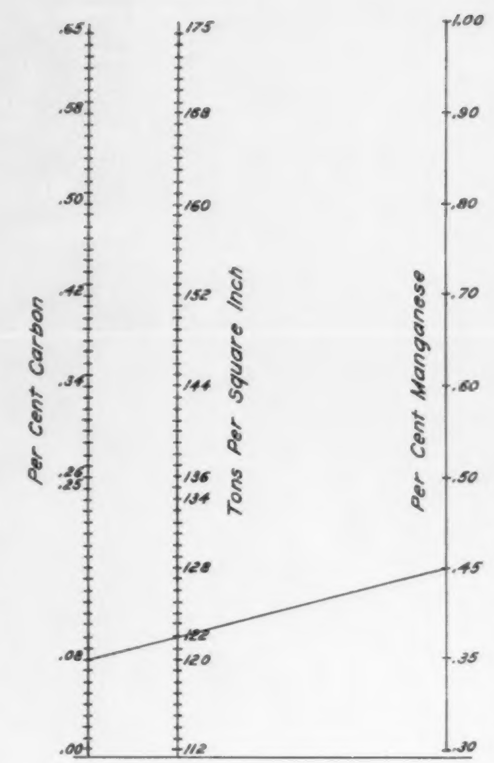
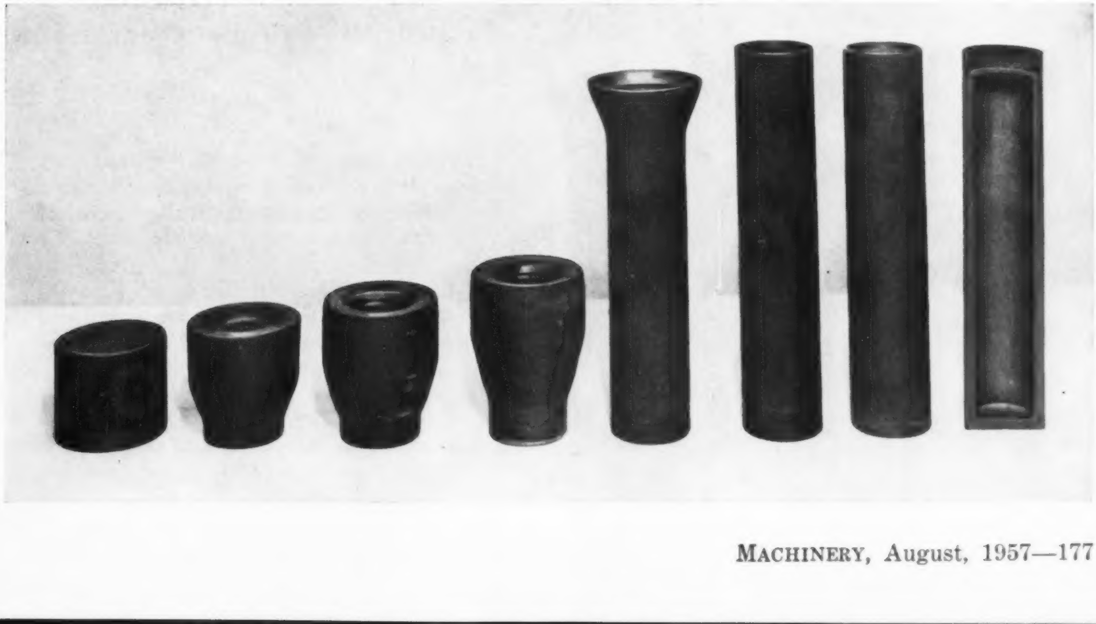
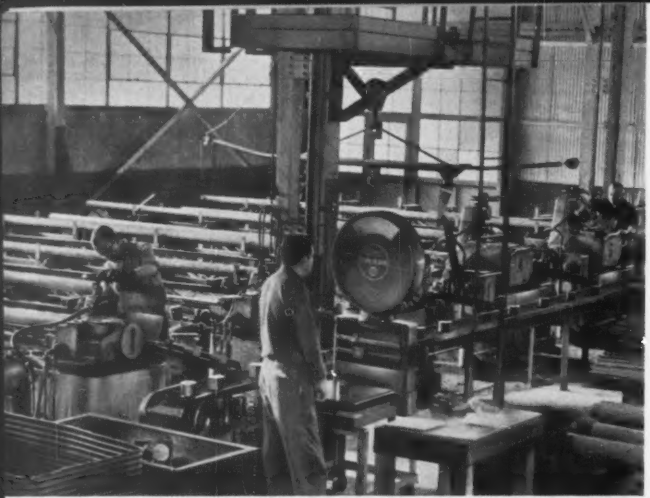
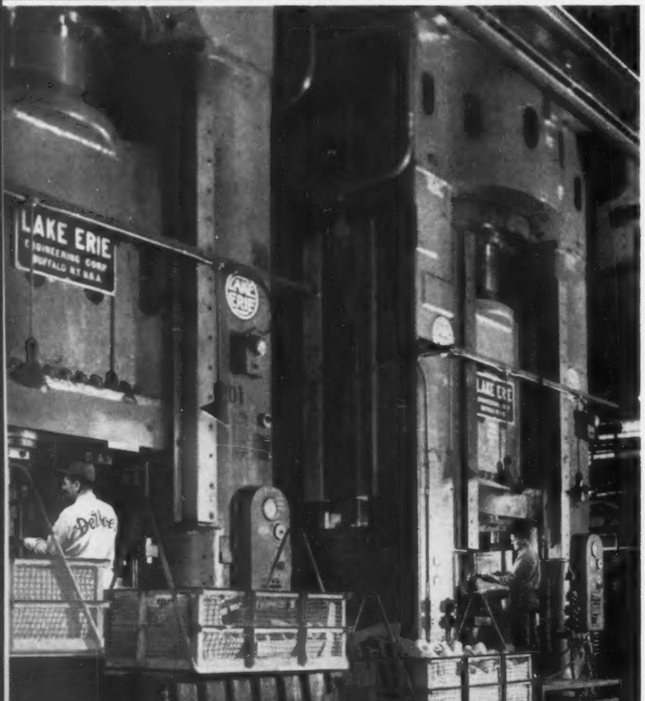


Fig. 2. To find tonnage required for extruding, a line is drawn from the carbon-content scale to the manganese-content scale.

Fig. 3. Original slug is at left. At right is a section through the finished tube. Intermediate views show work-piece after each of six press operations.







Metal is Pushed Either Backward or Forward

There are two cold-extruding techniques—backward extruding and forward extruding. In backward extruding, pressure is applied over the center of the work by the end of the punch. Restricted by a lift-out bar in the bottom of the die cavity, the metal is forced to flow backward around the punch body. If there is no drastic elongation required from slug to finished shape, one or two backward extruding operations might suffice.

On the other hand, where a stubby slug must be transformed to a slender cylinder, forward extruding is performed as a sequel to backward extruding. Here, the punch is designed with a shoulder. When the punch enters the hollow center of the work (already backward extruded), the shoulder pushes the metal ahead through the bottom of the die cavity. Clearance around the punch at the bottom of the die cavity is considerably less than the wall thickness of the work. As a result, the metal shoots ahead of the punch, thinning out the wall and elongating the work in the process.

Under the compression, the grain structure of the steel is refined, stringers are eliminated, and a hardness of 90 to 100 Rockwell B is developed. This hardness exists all through the wall of the part, not merely on the surface. Typical mechanical properties obtained for 1010 and 1012 steels are a tensile strength of 110,000 psi and a 0.2 per cent offset yield strength of 95,000 psi. Secondary operations, like threading, can be performed with high-speed steel tools.

Pressure required to induce the steel to flow is a function of the carbon and manganese content. From the chart shown in Fig. 2, pressures for 1005 to 1065 steels can be found by drawing a line from the carbon scale to the manganese scale.

Fig. 4. (Top) Every cold extrusion starts life as a slug. Here, bars are being cut up into slugs. The weight, not length, of the slug is critical and must be carefully maintained.

Fig. 5. (Center) Parts are removed from the pickling tank and will next be Bonderized and soap-coated. Slugs go through this procedure—and again when partly extruded.

Fig. 6. (Bottom) The first four steps are combined on these two presses. Each press is equipped with duplicate tooling, and there is a second operator in the back.

For example, 1008 steel with 0.45 per cent manganese requires an extruding pressure of 122 tons per square inch.

Pressure Tube Serves to Explain Process

Cold extrusion is best understood by tracing the processing of a typical work-piece through the Youngstown Kitchens plant. The part described is a torsion pressure tube. Mass-produced in three sizes, the tubes house the axle of a heavy earth-moving machine. In Fig. 3 are views of the part, as a slug and after each press operation. At the extreme right is a longitudinal section of a finished tube.

Dimensions are: length, 11 1/2 inches; outside diameter, 2 3/4 inches; and inside diameter, 2 inches. The integral bottom has the same thickness as the walls, 3/8 inch. At its top, the inside of the tube is enlarged to receive a gasket, as can be seen in the view at the extreme right.

Tube material is 1012 hot-rolled, 3 3/4-inch bar, with a 50 to 60 Rockwell B hardness. The slug length, about 5 inches, was determined initially by estimating the weight of the finished tube (plus the weight of a small amount of metal to be left on the top for a subsequent facing operation). Since the weight-per-inch of the bar stock was known, it was then possible to obtain a slug length equal in weight to the tube's. In this particular instance, the slug weighs 15 2/3 pounds.

A battery of Heller hydraulic saws, Fig. 4, cut the slugs from the bars. These machines automatically grip the stock, advance it to a stop, clamp it, and feed the saw carriage; then retract the carriage, unclamp the stock, and repeat the cycle. The cut-off slugs are directed down a chute from each machine to a chain conveyor. Since bar diameter varies slightly from one heat to another, the first slug from each heat is weighed, and a corresponding correction of slug length is made, if necessary.

Held in a hydraulically operated vise, the slugs are deburred by flying cutters, then go through a one-hour anneal at 750 degrees F. This heat-treatment reoxidizes the skin of pure iron oxide left on the material in the steel-making process.

Fig. 7. Each of these operators services two stations: a sizing station (to his right) and a first backward extruding station.

MACHINERY'S

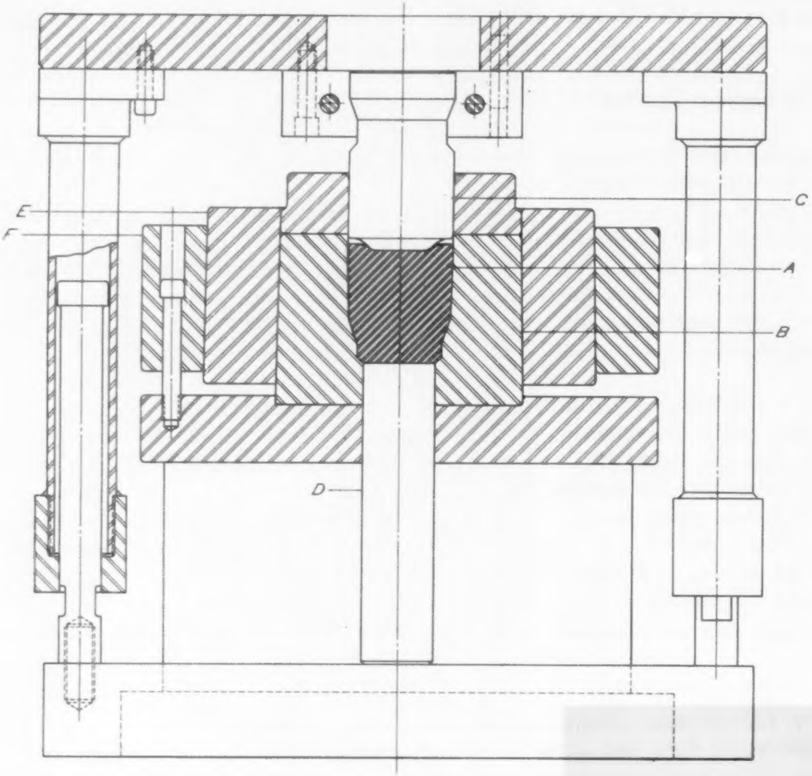


Fig. 8. In step (1), the punch forces the slug into the bottom of the die and hollows out the top of the slug.

With the skin reoxidized, subsequent pickling is speeded.

Loaded in wire baskets, the slugs are in turn immersed in pickling, phosphatizing and soap-coating tanks. Pickling—to remove the scale—consists of a ten-minute immersion in a bath composed of hot sulphuric acid (170 degrees F., 6 to 10 per cent concentration). In Fig. 5, a basket is shown being raised from the pickling tank.

Washed and neutralized in a soda solution, the slugs next are coated with phosphate. The phosphatizing solution consists of Bonderite 180X. Immersion period is seven minutes, and tank temperature, 180 degrees F. Soap-coating, the last of the preparatory steps, minimizes die wear. The soap solution consists of 70 pounds of Bonderlube 235 to 100 gallons of water. Temperature is 160 degrees F., and, here again, the immersion period is seven minutes.

Six Steps on Four Presses Involved

Cold-extruding the torsion pressure tube involves six different steps on four presses. These steps are: (1) sizing, (2) first backward extruding, (3) second backward extruding, (4) forward extruding, (5) removing flare on mouth, and (6) straightening. Steps (1) and (2) and steps (3) and (4) are combined on the two 3000-ton Lake Erie hydraulic presses seen in Fig. 6. Two 75-ton Bliss hydraulic presses perform steps (5) and (6).

A close-up view of steps (1) and (2) appears in Fig. 7. The press bed, 60 by 70 inches, is equipped with duplicate tooling, with one operator positioned in the front and another in the rear. Each operator services two die stations: a sizing station—step (1)—to his right, and a first backward extruding station—step (2)—to his left. For each cycle of the press, the operators, working in unison, load a new slug in the sizing station and transfer a sized slug to the first backward extruding station.

A cross-section of the sizing station is illustrated in Fig. 8. This view, and those of next

three stations (Figs. 9, 12, and 13) show the shape and position of the work at the completion of the press down stroke. In this sizing step, the slug *A* is forced into the die *B* by the punch *C*. There is a slight taper to the die cavity, it being larger in diameter at its top. The punch has a corresponding taper.

When loaded in the die, the slug enters about one-half the way. As pressure is applied, the slug fills the cavity, undergoing a reduction in diameter at its bottom and a hollowing out of its top by the nose of the punch. At the same time, any out-of-roundness in the slug is removed. Lift-out bar *D* restricts the flow of the metal at the bottom of the cavity.

Punches at all stations are made of Milne EPS steel. Die cavities are made of standard tool steel. Surrounding each die sleeve *E* is a heavy clamp ring *F* of boiler plate. This ring is a safety device, protecting the operator should the die burst under pressure.

At the first backward extruding station, Fig. 9, the sized slug is a free fit in the die when loaded. Here, the punch enters the hollow created in the slug top in sizing. In descending, the metal is displaced backward. Actual extruding is now under way. The die *B* restricts the outward flow of the metal, and forces it to flow opposite to the directional movement of the punch. In this and succeeding steps, the punches are the same diameter as that of the finished tube.

Annealing Interrupts Press Operations

Pressure required for the two sizing stations and two first backward extruding stations totals 2000 tons. Leaving the second station, the parts have work-hardened to approximately 95 Rockwell B, so must be annealed before extruded further. To shorten the time of this heat-treatment, it is performed immediately, since the parts have a temperature of about 325 degrees F. as they are taken from the press.

As can be seen in Fig. 10, the work is heated electrically along two lines. Each line contains a box in which is a large cylinder having a low-frequency induction coil wrapped around its outside. In the illustration, a worker is shown loading the chute leading to the box in one of the lines.

Electrically charged as well as heated, the cylinder attracts the steel parts, automatically drawing them forward. Once within the cylinder, the parts are raised to 1450 degrees F.—the Curie

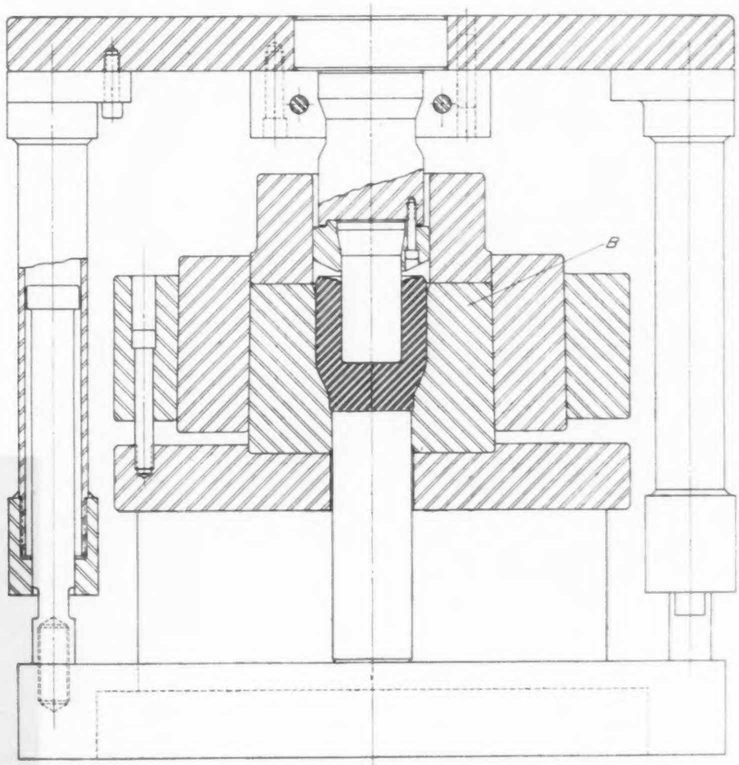


Fig. 9. In step (2), the first backward extrusion takes place. The metal is forced upward as the punch descends into work.

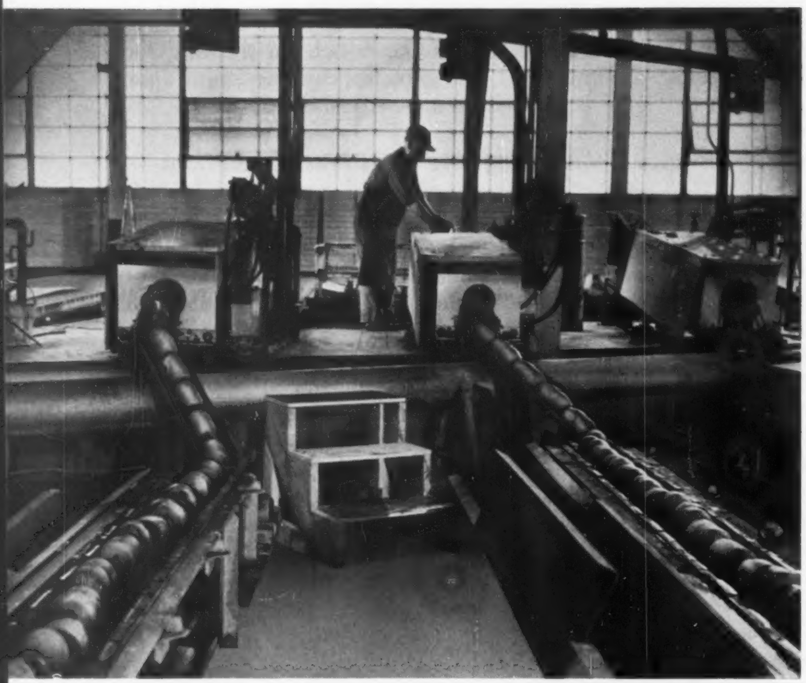


Fig. 10. The low-frequency induction coils around the cylinders in the boxes attract the work, providing an automatic and continuous feeding means.

point—and temporarily lose their ability to be attracted magnetically. By coincidence, this is also the desired annealing temperature.

Meanwhile, the feed of the work continues. Parts at the entrance of the cylinder are drawn in as they come into the magnetic field, pushing the parts ahead of them toward the end of the cylinder. This process is continuous. Leaving the cylinder, the parts regain their ability to be attracted magnetically as they cool on conveyor belts. The annealing lines were conceived and built by company personnel.

A stress-relieving furnace is located adjacently to the lines, and the parts are directed through it. In Fig. 11 is shown the exit end of this furnace. The heat-treatment consists of a one-hour cycle at 750 degrees F. (The earlier heat-treating of the slugs to soften their skin of pure iron oxide, already described, proceeds simultaneously in the same cycle and in the same furnace.) When again pickled, Bonderized, and soap-coated, the work is ready for further extruding.

The heading illustration is a close-up view of the other Lake Erie press, on which the second backward extruding and the forward extruding to finished length, steps (3) and (4), are performed. Like the other press, it is equipped with duplicate tooling, with one operator positioned in the front and another in the rear. Cross-sections of the two different stations are shown in Figs. 12 and 13.

Lift-Out Bar "Spots" Hole in Bottom

In step (3), Fig. 12, more metal is displaced from the bottom of the cylinder, which now reaches finished thickness. In addition, the length of the extrusion is increased. Wall thickness, however, remains the same. Also, a conical indenta-

Fig. 11. Partly extruded tubes emerge from the annealing furnace, the second stage of the heat-treatment. In the same cycle, the iron oxide skin on the slugs is softened.

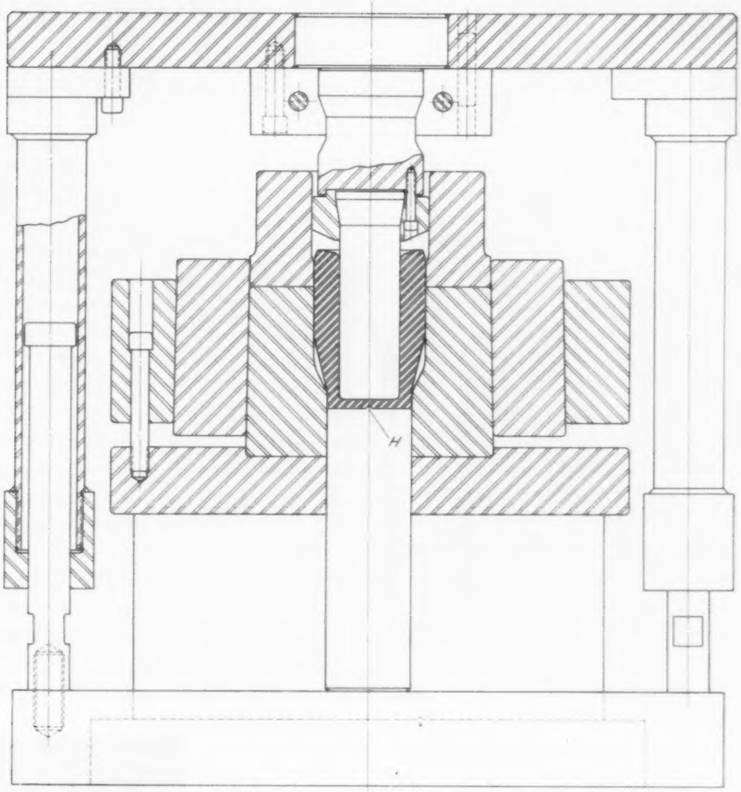


Fig. 12. In the second backward extruding, step (3), the bottom of the tube is reduced to final thickness and a hole for a grease fitting is "spotted."

tion H in the bottom of the part is produced in this step. The indentation is carried by a point on the end of the lift-out bar and is used to "spot" a hole, later drilled and tapped for a grease fitting.

The cross-section of one of the two forward extruding stations, Fig. 13, shows the tube bottom well ahead of the punch when the press has reached the extremity of its down stroke. In this step, the pressure is applied by the punch shoulder against the top of the work (in contrast to the previous steps, where pressure was applied by the punch end against the bottom of the work).

As received from step (3), the work fits the upper part of the die. The lower part of the die, corresponding to the outside diameter of the finished tube, is blended to the upper part of the die by a large radius J. This radius assists the flow of metal as the punch descends. The smaller area around the punch in the lower part of the die causes the metal to shoot ahead of the punch at about three times the press speed.

Because of the decided difference in the length of the work in steps (3) and (4), the longer punches of the forward extruding stations enter their respective dies ahead of the punches at the second backward extruding station. Pressure required for the forward extruding totals 1200 tons, then rises to 2000 tons when the second backward extruding punches start to operate.

No annealing is required after step (4), as was necessary after step (2). The reason is that less metal is being displaced as extruding progresses with less work-hardening developing, even though the shape of the work undergoes drastic change. Actual extruding is now completed, the tube having reached final length, diameter, and wall thickness. Two steps remain: step (5), to remove the flare on the mouth and create a recess for a gasket; and step (6), to straighten the tube.

Step (5) is illustrated in Fig. 14. The flare on the tube being loaded was produced in step (4) by the radius in the die and must now be removed. Here, punch and die are of simple construction. The flare disappears as the tube is

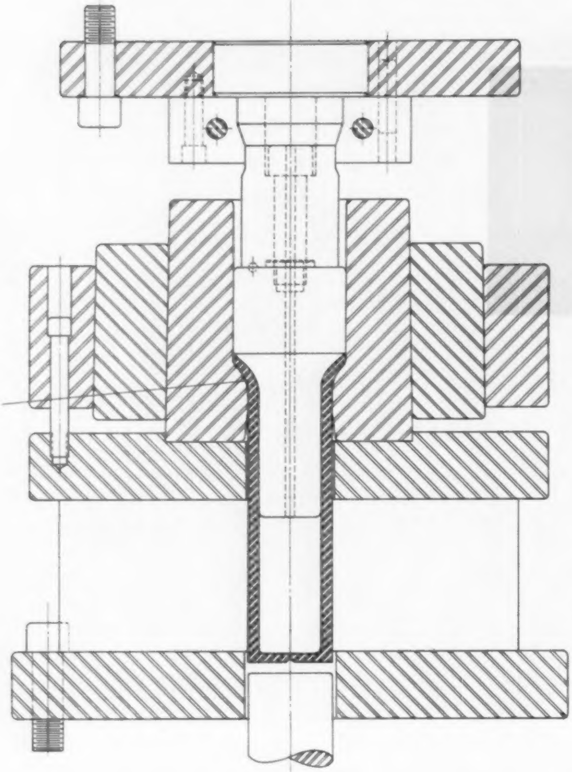


Fig. 13. (Left) In the forward extruding, step (4), the final outside diameter and length of the tube are obtained.

Fig. 14. (Below) The flare is removed by pushing the tube through an ordinary round die. A shoulder on the punch creates the gasket diameter.

forced through the die. There is a short shoulder at the top of the punch which produces the gasket diameter at the tube mouth.

Since the metal is unrestricted as it shoots ahead of the forward extruding punch (see Fig. 13), tube straightness and concentricity may be affected. Thus the need for step (6). Another simple punch and die (not shown) perform the operation.* Except for a small amount of metal on the mouth end of the tube which is removed in a lathe, the cold-extruded tube is completed. The tolerances held are as follows: straightness, 0.002 inch per foot; wall thickness, plus or minus 0.005 inch; and concentricity, plus or minus 0.002 inch.

**Editor's Note:* Of related interest is a press process, "Kauling," developed by the author to straighten tubes. An over-size punch is forced into the tube, held loosely in a die at one station. This straightens the inside of the tube. Then, with the tube frozen to the punch, the punch is raised and a mechanism indexes the punch to a second station. There, the punch forces the tube through an under-size die, straightening the outside. On the press up stroke, the tube is stripped off the punch and falls into a chute beneath the bolster. Since the tube is formed under compression, an increase in tensile strength as much as 30 per cent is obtained in straightening.

Free-Piston Turbine Engine Used in Experimental Tractor

HEART of Ford Motor Co.'s free-piston turbine engine which powers the Typhoon experimental tractor is the gas generator, or gasifier, shown in cross-section in the accompanying illustration. This gasifier is a two-cycle engine, having a compression stroke and a power stroke. The turbine, not drawn to scale, is seen in the insert.

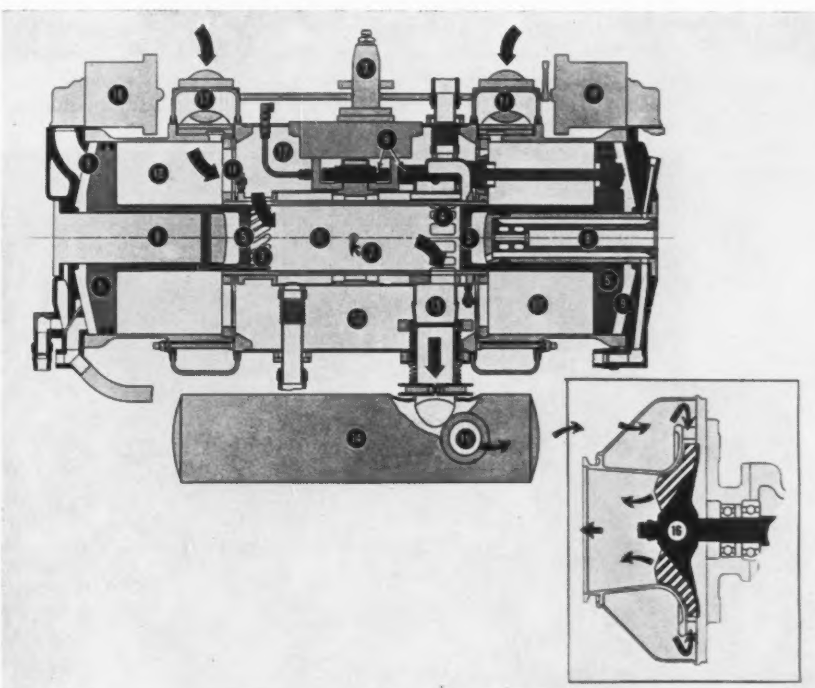
Combustion cylinder 1 with fuel injector nozzle 2 is water-cooled along its length. Intake ports are at 3, and exhaust ports at 4. Two "free" pistons 5 are linked together mechanically by a rack-and-pinion arrangement 6, so that they move inward and outward the same distance and at the same time. The fuel injector pump 7 is actuated by a cam on one of the racks.

The pistons slide on fixed supports 8 and are oil-cooled and lubricated as they move. In the position shown, the pistons have compressed the air in the "bounce" cylinders 9. This air, acting as a spring, will force the pistons toward the middle of the combustion cylinder.

During the compression stroke, air is forced from the compression cylinders 10, through reed valves 11, into the air "box" 12. Entrapped air in the combustion cylinder is also compressed, reaching the ignition temperature at the time fuel is injected. On the power stroke, the pistons are forced outward by the expansion of burning gases. This movement uncovers the exhaust ports first, allowing most of the heated gas to leave the cylinder through the exhaust tube 13.

Then, the intake ports are uncovered, and air from the air "box" flows through the cylinder, thoroughly scavenging it, and mixing with the hot gases in the surge tank 14. The outward moving pistons compress air in the "bounce" cylinders, and this compressed air again provides the rebound to move the pistons inward for the compression stroke. The diluted hot gases flow from the surge tank through a port 15 to the turbine wheel 16, which revolves to power the tractor.

As the pistons move outward after the fuel charge has been ignited, outside air is pulled into the compression cylinders through butterfly and reed valves at the air intakes 17. To activate the pistons for the initial start of the engine, a vacuum pump (not shown) draws air out of the "bounce" cylinders to pull the pistons back into the position shown. Starting "cans" 18 then provide a measured amount of air under pressure to the "bounce" cylinders to force the pistons inward for the initial compression.



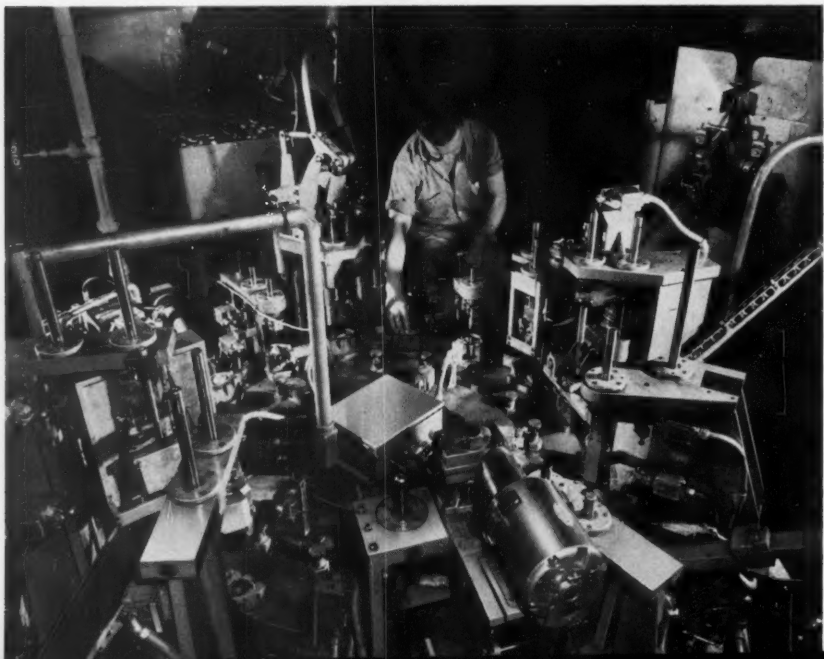
Gas generator of free-piston turbine engine employed to power an experimental tractor

IN SHOPS AROUND THE COUNTRY

Camera highlights of some interesting operations performed in various metalworking plants throughout the nation

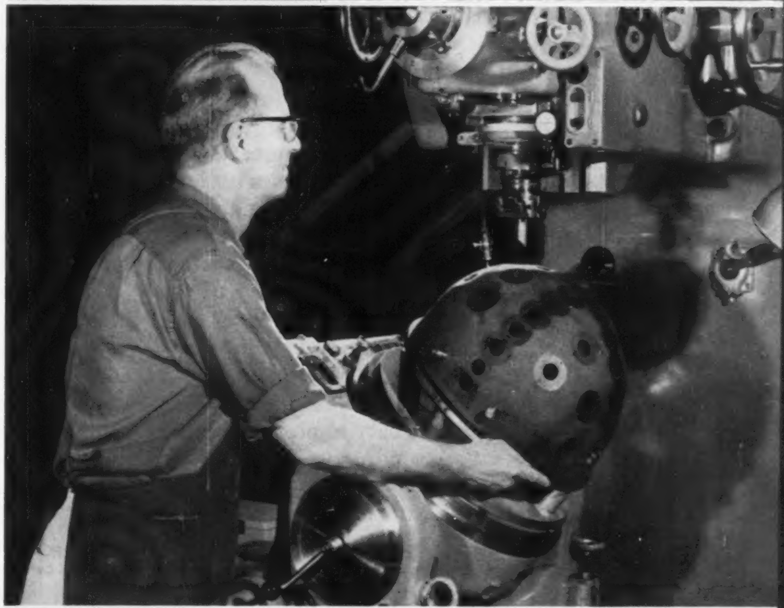
MACHINE-AGE SCULPTOR—Six 46-inch long exhaust blades for steam turbine are contoured simultaneously on a special Cincinnati milling machine at Allis-Chalmers' West Allis, Wis., Works. Cutters are controlled from a master shape mounted at the left-hand side of the machine. Approximately fifty operations are involved in producing these blades, the longest 1800-rpm blades ever used in a steam turbine.

CIRCULAR ASSEMBLY "LINE"—Assembling front-suspension sub-assemblies at the rate of 1200 per hour at Ford Motor Co.'s new chassis parts plant in Sterling Township, Mich. Operator loads basic part on a multiple-fixture, circular table which indexes through several automatic work stations and returns completed assembly to him. Below-standard parts are rejected automatically.

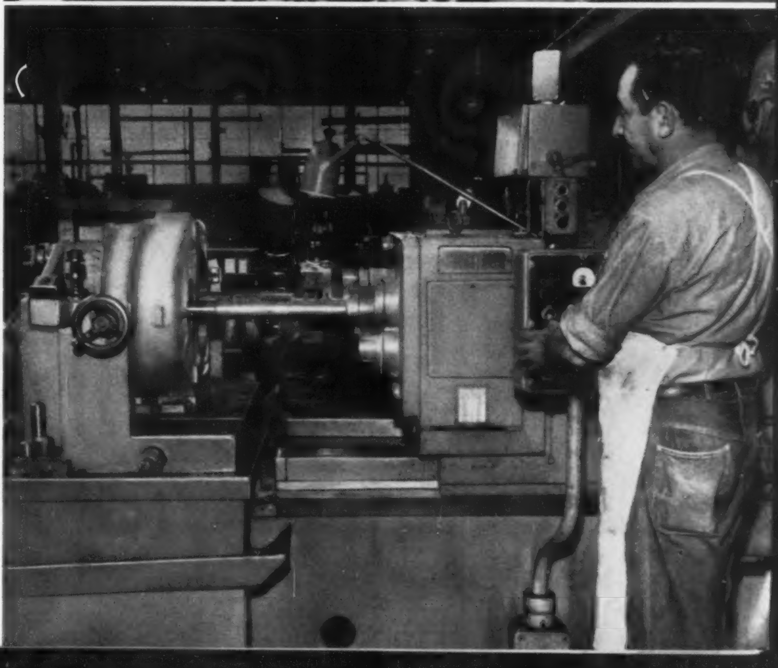


TOOLPOST SQUEEZE PLAY—At Bronson & Bratton, Inc., Chicago, Ill., pliers hold diamonds which bore tapers in Carboloy die inserts for forming brass shell casings. In this work, diamond edges do not stay sharp long enough to use permanent holders. Finding the sharp edges to apply to the work requires a high degree of skill.

HOLEY SIGHT— Boring bearing holes in a test fixture for hemisphere sights at General Mills, Minneapolis, Minn. The sight is part of the tail defense system of the B-52 bomber. Lindner optical jig borer used has automatic table positioning device. While one hole is being bored, operator pre-selects table position for next hole.



BORING, BUT INTERESTING—At Austin-Western Co., Aurora, Ill., a Sundstrand double-spindle machine line-bores gear cases for road graders. Basic fixture has bearings which pilot the various boring-bars used. Each size of gear case has an individual locating fixture used in conjunction with the basic fixture.



From Gaslight to the Atom—Era of E. W. Bliss Progress

IN 1857 Eliphalet Williams Bliss began his career as a press builder, and so, the company he founded is celebrating its one-hundredth anniversary this year. From a tiny press-building operation, the business has expanded into a corporation having eleven plants in five states, a Canadian subsidiary, overseas operations in England and France, and two subsidiaries in the United States.

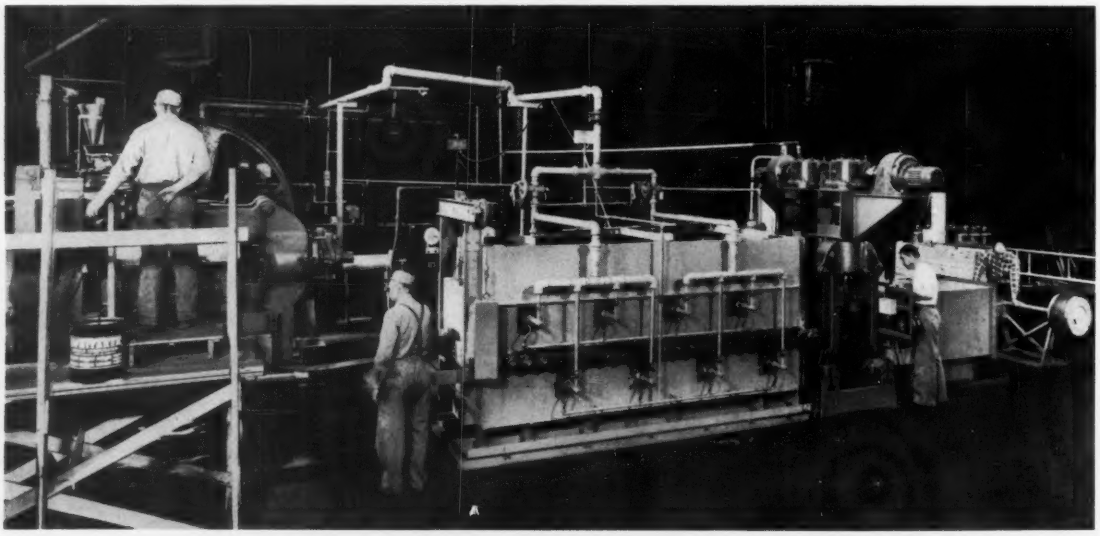
The mechanical and hydraulic presses which the company builds today serve every industry that uses metal as a raw material. Its presses range from small high-speed units that produce delicate electronic grids and plates up to giant machines that can shape an aluminum ingot into an aircraft part with one mighty squeeze. One automated installation which includes a large press with a transfer-feed system produces refrigerator shelves and crisper pans from 22-inch wide coil stock at the rate of fifteen shelves and ten pans per minute. A far cry from the early incline press with its primitive roll feed, but a direct descendant nevertheless.

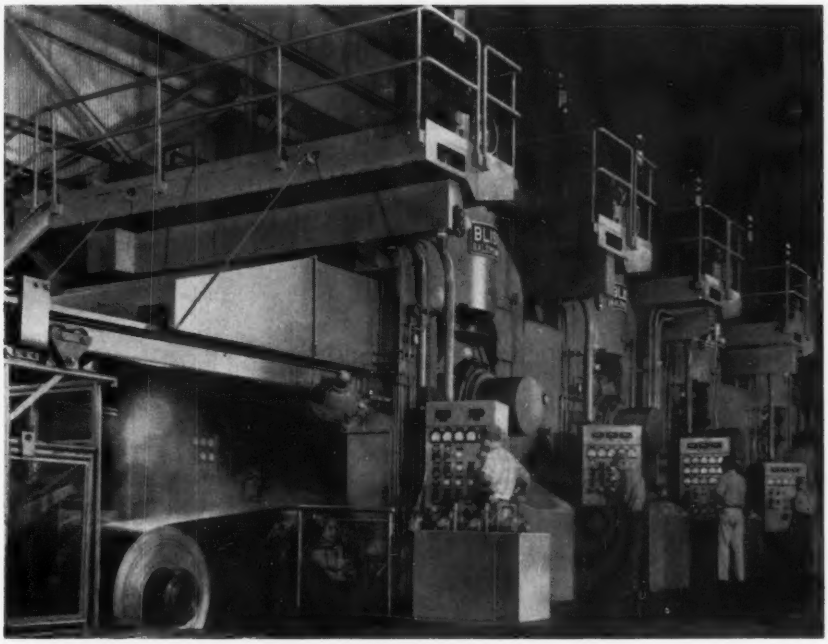
While the E. W. Bliss Co. is best known in some branches of the metalworking industry for press manufacture, it has carved niches for itself in other branches of the industry. For thirty-five years, for example, the company has been in the rolling-mill field. In the early days of this activity, the concentration was on special mills and accessories. In recent years, however, it has also built complete continuous hot-strip mills for some of the nation's biggest producers of both ferrous and non-ferrous metals. At the present time, the company is completing a contract which called for the construction and furnishing of a complete cold-rolling mill for the Jones & Laughlin Steel Corporation.

One of the latest developments is a chemical method of producing copper powder economically from scrap material and transforming it into strip, tubing, and wrought shapes. Strip stock produced by this method possesses all of the physical properties of hot-rolled strip made under conventional practice with the exception, perhaps, of a slightly less density. The same process can be used for other metals and, for example, titanium strip stock has been produced from powdered metal. The Chemetals Corporation, in which Bliss holds a 20 per cent interest, has the American rights for this process, but Bliss is playing an important part in designing and building equipment for its practical application.

As far back as 1857, Bliss presses were bought

Revolutionary process made practical by this line of equipment transforms metal powder directly into copper strip at an estimated saving of 80 per cent of conventional rolling costs.





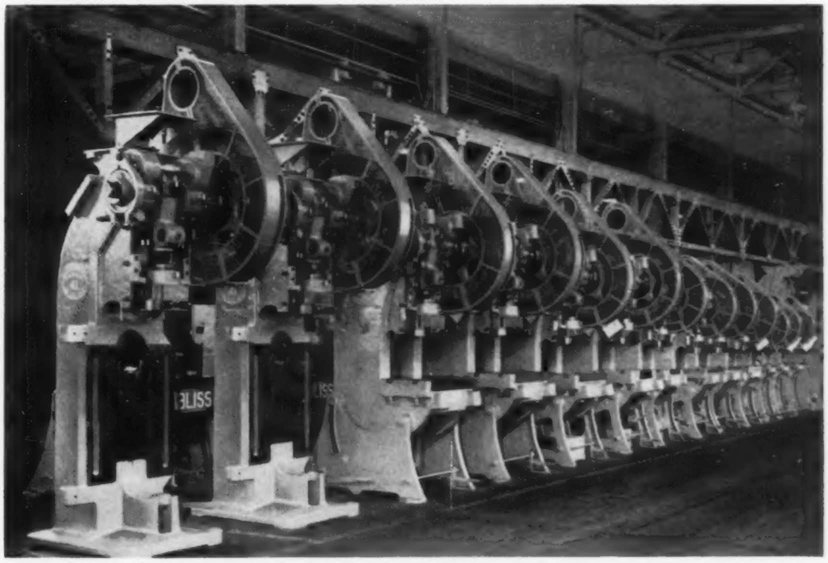
Bliss four-stand, tandem cold-rolling mill which produces wide steel strip in coils weighing 34,000 pounds at speeds up to 1865 feet per minute.

by the tin-can industry, and the company has consistently developed equipment for that branch of metalworking, which now turns out approximately forty billion cans each year. One high-speed machine turns out 450 can bodies per minute. Features of this machine include a single-station double-action edger, a blank flexer, a device for removal of chips from the notcher by compressed air, an improved soldering attachment, a cam-actuated overhead blank lock, and a stationary forming horn.

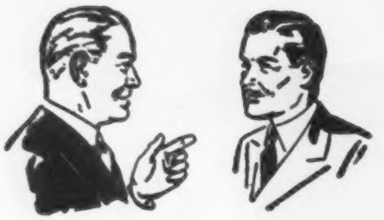
There is also a strip-feed press that turns out 600 can ends per minute. Beaders, curlers, seamers, flangers, shears, slitters, thread rollers, trimmers, and other types of equipment complete the line of can-making machinery.

Another important activity is contract work, the company being prepared to build almost any type of special machinery or equipment. Recently, the company announced a "turnkey" plant idea which involves building a plant from top to bottom, installing all machinery, and training the operating company's personnel. Under such a plan, the buyer needs only to "turn a key" to start the plant in full operation.

Bliss also operates a division which not only manufactures die-sets, but also distributes a complete line of die supplies.



Mass production of inclinable presses is carried out at the San Jose, Calif., plant, one of eleven American plants owned by a company that expanded from a Brooklyn loft.



Talking With Sales Managers

By BERNARD LESTER
Management Consulting Engineer

Easing the Shortage of Engineers

ADDED to the mounting expenses of selling and servicing is the current rise in the cost of obtaining technically trained men.

The contest to attract qualified men seems to be getting out of hand—with excessive promotion, enticements that misrepresent, the raiding of competitors, and promises unfulfilled. We are beginning to see some of the bad effects from these whirlwind campaigns to get men.

One technical student received forty-eight offers, and more than half led to interviews. Did not all this interview time interfere with his education?

Another young man, flown to his prospective employer's headquarters, lunched with the president. He finally "accepted" this company as an employer. Six months later he complained "Now I am just a cog in the gear train. The president gives me the 'absent eye' when we pass."

Still another graduate has changed jobs three times in three years. He now has the job-frog complex and accepts it nonchalantly. But is he altogether to blame?

The fishing paraphernalia to hook technically trained men in the stream of education and the waters of industry grows more elaborate, costly, and ineffectual. Repeatedly, contractors and fabricators confronted with a big job snag men at an exorbitant cost and with only a bare chance of providing permanency or an open alley for advancement. The most dangerous result is the destructive effect that these practices will ultimately have on a large number of professionally trained men.

We can help relieve the shortage of engineers by putting engineering talents to better use, accelerating on-the-job training, and selecting graduates more intelligently, so as to minimize future loss.

It will pay to examine the work load of each department member. One sales manager who reported loss of business due to shortage of sales engineers found later that some of his men were insufficiently busy.

Irrespective of work load, ferret out engineering capacity spent on nontechnical work. Many trained engineers are assigned even now to semi-clerical jobs. Some authorities hold the shortage of engineers would quickly disappear with a rearrangement of duties.

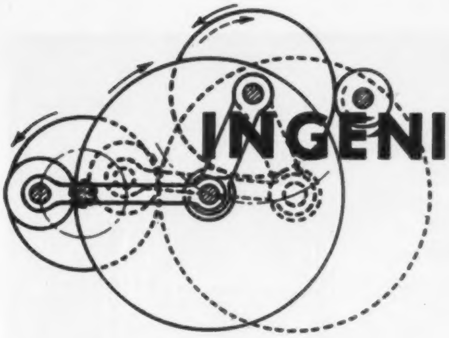
This emphasizes the importance of job definition and assignments according to abilities and skills. Pass routine technical duties to selected clerks and help them reach up and grow. Many of industry's best engineers got their training while working. The "bottoms up" principle of management development applies to engineers.

The shortage of engineers places new emphasis on selecting young men below the graduate level and opening the gate wider for an on-the-job technical training. With more boys turned down by the engineering schools, a good source of help might be the director of admissions. Trade schools and junior colleges deserve greater attention, provided we have a workable plan for technical training.

No one is more conscious of the growing evils of recruiting than officials and staff of our engineering schools. Interviewers descend upon the college like a swarm of locusts. Scalp collecting rates high. Some try to beat the gun. Practices may develop that destroy a happy relationship between employer and school. Excessive time is stolen from academic work. Undergraduates are upset and given false notions about industry. A committee of the American Society for Engineering Education has examined the situation and has issued a very helpful booklet entitled "Recruiting Practices and Procedures," available for a small fee.

Although schools permit each corporation to recruit graduates, they should give support to employers with sound policies and a record for developing men. We have previously advocated in this column that the average-size engineering concern should work intimately with a few engineering schools rather than distantly with many.

Statistical forecasts show the shortage of engineers will increase. The temptation to use unbusinesslike and unethical methods to lure men will increase rather than lessen. Meet the situation now head on.



INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Handling Mechanism Turns Strip in Transfer

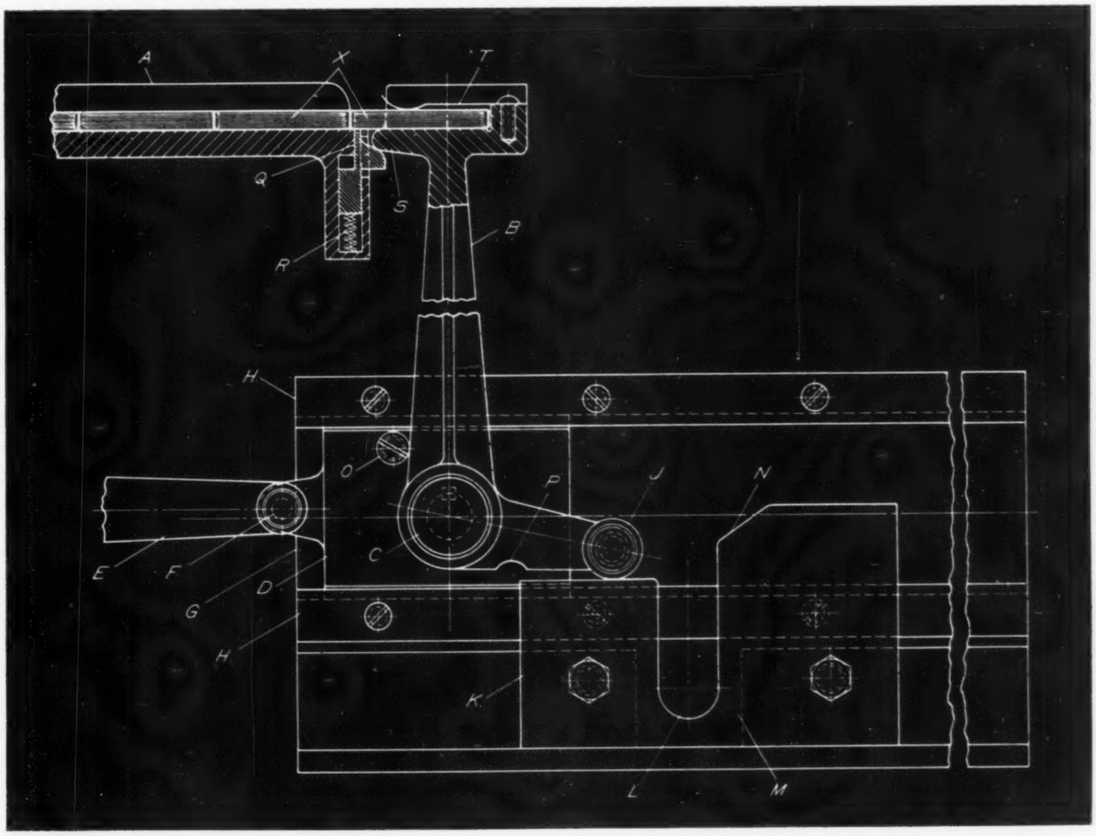
By W. M. Halliday, Southport, England

In processing fiberboard strip for a patented firelighting device, an interesting materials-transfer mechanism is used. This mechanism picks up the strip as it leaves the saw table, rotates it 90 degrees so that a combustible fluid can be injected into one edge, then rotates it another 90 degrees for ejection.

In Fig. 1, several strips *X* can be seen leaving an extension *A* of the saw table. The strip is advanced manually between raised guides into the fingerlike end of the long leg of a bellcrank *B*.

The bellcrank is keyed to a stud *C* free to revolve on a rectangular slide *D*. Connecting-rod *E*, pivoting at *F*, reciprocates the slide in body casting *G*. The opposite end of the connecting-rod (not shown) is actuated by a conventional eccentric disc. The slide is T-shaped in vertical section, so that it can be retained by keeper plates *H*.

Fig. 1. When bellcrank (B) starts its swing, roller (J) rides over the lower horizontal surface of guide plate (K).



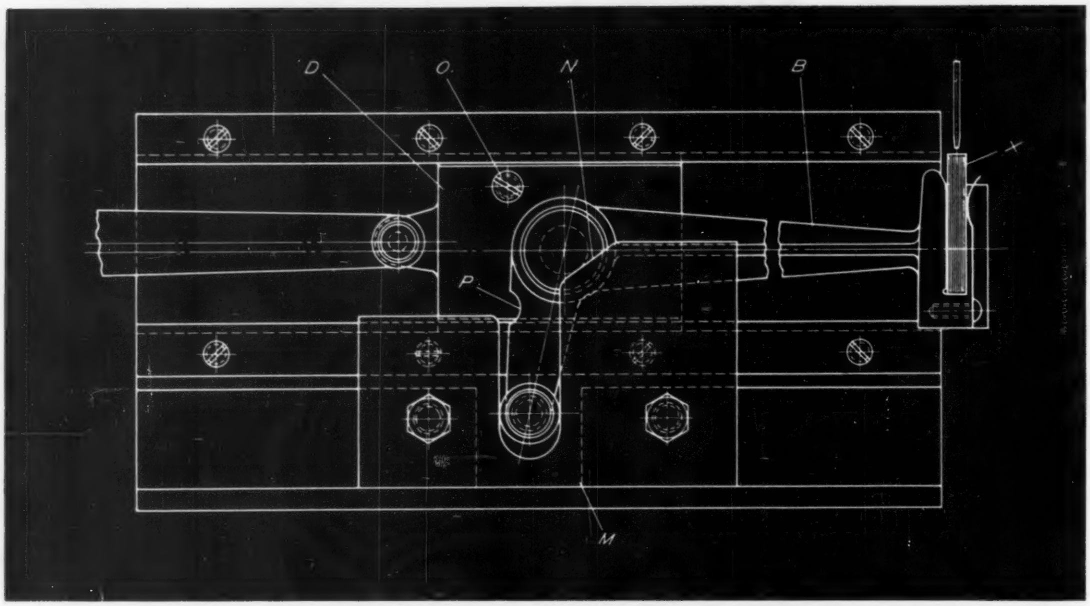


Fig. 2. A momentary dwell of the eccentric disc permits injection of combustible fluid.

The short leg of the bellcrank forms an angle of 102 degrees with the long leg. At its end, it carries a roller *J* projecting over the front of the body. The roller operates over the upper edge of a guide plate *K* fastened to the front of the body.

When the slide moves to the right, the bellcrank carries along one of the fiber board strips, moving until roller *J* contacts the right-hand wall of slot *L* in the guide plate. The roller then is forced down in the slot, approximately 0.005 inch wider than the roller diameter. Meanwhile the bellcrank, fulcruming on stud *C*, rotates the strip

Fig. 3. Recess (P) in the short leg contacts pin (O) in rectangular slide (D), limiting the movement of bellcrank (B).

90 degrees, Fig. 2. A clearance channel *M* accommodates the short leg of the bellcrank.

Now there is a momentary dwell of the eccentric disc to allow the combustible fluid to be injected. Then, continued movement of the slide in the same direction raises the roller out of the slot, first onto an adjacent 40-degree incline *N*, then onto the higher straight edge of the guide plate. Simultaneously, the strip is rotated downward 90 degrees more, Fig. 3. After the strip is ejected, the slide moves to the left, and the bellcrank returns to its initial position.

Pin *O* (pressed into the slide) offers a positive stop for the bellcrank, bearing against the long leg at the start of the cycle, and against a recess *P* in the short leg when the bellcrank reaches the position shown in Fig. 3. A small, vertical slide *Q*, Fig. 1, prevents the strips remaining on the extension from being pushed off once the long leg is loaded and the bellcrank starts its swing. This slide is in a lip on the extension bottom, and a spring *R* keeps it raised, once the bellcrank swings away, so that the end of the slide slightly intersects the path of the strips.

At the start of the cycle, a projecting surface S of the long leg depresses the slide, and the foremost strip is advanced into the leg. There, the strip is retained by a leaf spring *T*. To release the strip when it has reached the position shown in Fig. 3, a forked ejector plate *U* is actuated by separate mechanical means at the proper instant.

Since the strips are relatively long, there are several identical transfer mechanisms involved. All are arranged in line and function together.

Automatic Half-Nut Release for Thread Cutting

A mechanism that permits easy manual engagement and automatic disengagement between the half-nut and the lead-screw of a lathe is here illustrated. With this arrangement incorporated in the lathe apron, screw threads can be cut close to shoulders at a rapid rate.

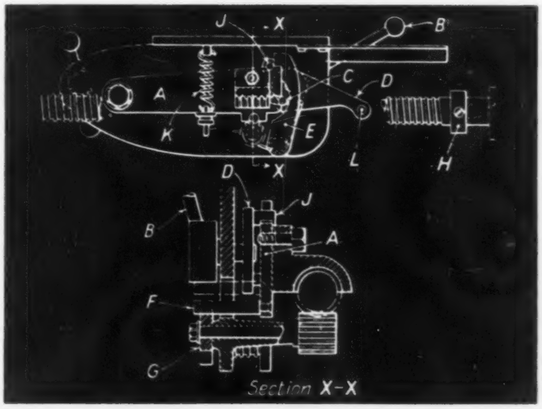
A single half-nut is carried on the unrestrained end of arm *A*, and is swung downward to engage the lead-screw by an upward movement of hand lever *B*. Any positional change of lever *B*, which is conveniently mounted on the front of the apron, is transmitted to the half-nut by pin *C*. This pin is attached to plate *D* and engages with a slot in the end of arm *A*. Plate *D* is connected to lever *B* by a shaft that passes through the apron. When the half-nut is engaged with the lead-screw, pawl *E* is turned counterclockwise by a spring to interlock with the upper end of arm *A*. In this manner, the half-nut is held in positive engagement with the lead-screw.

Referring to section X-X in the illustration, engagement of the half-nut is controlled by disc *G* which operates in conjunction with pin *F* on arm *A*. Disc *G* has two diametrically opposite slots, and, when screw-cutting is not actually in progress, is driven by a gear in mesh with the lead-screw. The disc replaces the screw-cutting dial usually provided on the carriage.

With this arrangement, upward movement of lever *B* causes pin *F* to make contact with the disc, so that the half-nut is temporarily held out of engagement with the lead-screw. The engagement is made when one of the slots in the disc is presented to pin *F*. In this way, the engagement of the half-nut is synchronized with the angular position of the work-piece in relation to the cutting tool.

At the end of the cutting stroke, an extension *L* on plate *D* makes contact with adjustable collar *H* mounted on the lead-screw. In consequence, plate *D* is pivoted in a clockwise direction. A second pin *J*, attached to this plate, causes pawl *E* to release arm *A*. At the same time, this arm is swung upward by the action of pin *C*, assisted by tension spring *K*, so that the half-nut is automatically disengaged. The cross-slide is then moved by hand so that the cutting tool is brought clear of the work, and the carriage is traversed toward the tailstock in preparation for taking the next threading cut.

An alternative method of insuring correct timing for engagement of the half-nut depends upon a tripping device, located at the left-hand end of the headstock which is coupled to the apron mechanism by a cable.



Lever (B) is raised manually to engage the half-nut with the lead-screw, and adjustable collar (H) trips extension (L) for automatic release.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Fixture Facilitates Grinding of Eccentric Work

By W. M. Halliday, Southport, England

In the grinding of eccentric parts, problems are sometimes encountered by the manufacturer in maintaining close tolerances. Such a problem arose in planning to machine eccentric work-pieces of the type shown in Fig. 1. The cylindrical and tapered end *a* is offset from the main portions of part *b* and flange *c*, which have a common center line.

The fixture in Fig. 2 was designed to locate diameter *a* concentric to the machine spindle and at the exact amount of offset required. Baseplate *A* has a flange turned on the back face for mounting on the machine spindle and is secured by four cap-screws through *B*. Shoulder *C* is turned on the front face of the baseplate to locate the fixture concentrically. Member *D* of the fixture is a cast-iron bridge with the top face *E* bored to fit on shoulder *C*. Four cap-screws *F* hold the bridge to the baseplate.

Hole *G* is bored through the bottom face of the bridge (at the suitably offset centerline X-X) to receive the part, which is located in the fixture

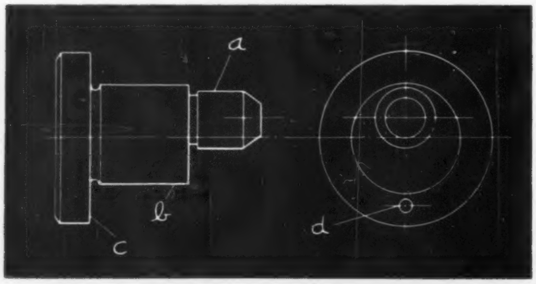
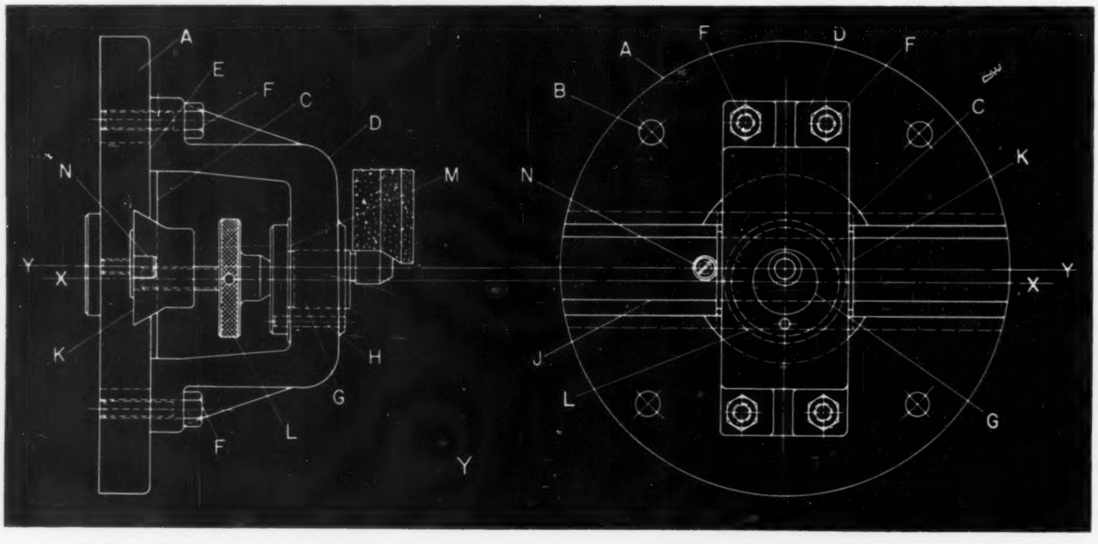


Fig. 1. (Left) Eccentric work-piece conveniently ground by employing the fixture shown in Fig. 2.

Fig. 2. (Below) Fixture designed to facilitate maintaining close tolerances in grinding of work-pieces having an eccentric cylindrical surface.



by dowel-pin *H*. This pin engages closely in hole *d*, previously machined in the work-piece. Care must be taken to bore hole *G* in the fixture and the dowel hole in the work with their center lines offset the required distance from centerline Y-Y to insure accurate positioning of the work.

To clamp the work-piece in the fixture, a dovetailed guide way *J* is machined diametrically across the front of the baseplate to fit slide *K*. This slide carries the clamping screw *L*, which has a hardened nose that presses against the back of the work and holds it firmly against machined face *M* on the bridge. The nose of screw *L* should bear approximately against the center of shoulder *c* on the work-piece. A stop-pin *N* is added to regulate the position of slide *K*.

Simple Radius-Bar for Spherical Turning

By Frank L. Rush, Columbus, Ohio

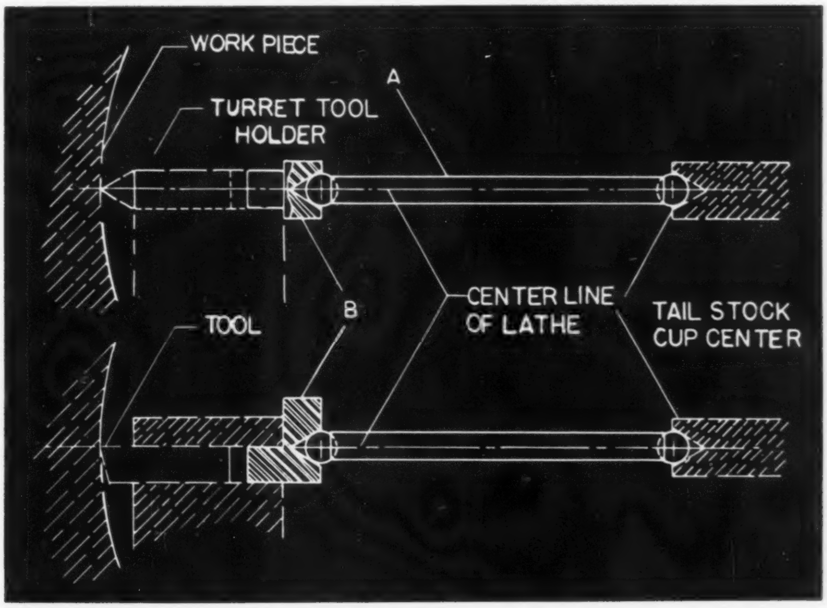
When turning large spherical recesses in a number of work-pieces, some form of radius-bar will generally prove convenient. A simple, two-piece arrangement of such a device is shown (as set up in a lathe) in the illustration.

Radius-bar *A* is machined to have truly spherical ends. The distance between the geometric centers of these spherical surfaces is made equal to the radius of the desired recess. One side of centering block *B* is provided with a key to fit the turret tool-holder of the lathe, and a conical recess is machined in the opposite face. This recess is sized to suit the spherical ends of the bar and is located centrally with the top surface of the key. A cup center, mounted in the tailstock, is used to pivot the other end of the bar.

To produce a true sphere, the tool must be mounted in the holder so that the cutting point is located on the extended axis of the conical recess in the centering block. This axis must also be parallel to and in the same horizontal plane as the center line of the lathe.

In operation, the work is center-drilled, and the tool is set at the center of the work for cutting. One end of the radius-bar is then placed in the recess in the centering block, and, with the tailstock clamped to the lathe bed, the cup center is advanced until it contacts and supports the other end. The tailstock spindle is then locked in this position.

A spherical surface is machined in the work-piece by slowly feeding the cutting tool out with one hand, while using the other hand to keep an even pressure on the radius-bar with the carriage handwheel. Cuts are always taken by feeding out from the center, with the tailstock spindle being advanced for each cut. The bar should be removed and the carriage backed off when returning the tool to the center of the work. Many variations of this radius-bar are possible.



Radius-bar of simple construction as set up in a lathe for turning large spherical recesses in work-pieces.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts and

Spar Mill for Multiple-Jet Seaplane

A 96-foot long, double-carriage, spar-milling machine will turn out the wing structure of the U. S. Navy's new Martin SeaMaster multiple-jet seaplane. The machine was built by the Onsrud Machine Works, Inc., Niles, Ill. The carriages are gantry type: one carriage has two vertical milling heads, and the other carriage has four horizontally opposed milling heads. Both carriages can operate simultaneously, or one of them can be "parked." Similarly, all six heads can operate at one time, or in any required combination.

The heads have electronic tracer-controlled feeds for transverse, rise-and-fall, and twist movements. Longitudinal feed is produced by the travel of the carriages. Template-to-cutter ratio is 1 to 1 for linear feeds and 0.180 to 1 degree for twist feeds. Mechanical contact of tracers by followers is converted to electronic signals which feed back to control head positions. There are 204 control stations, about 16 miles of wiring, and forty-three electric motors. Coolant use is at the rate of 200 gallons per minute. Operators ride platforms on the carriages.

Over-all size of this particular machine is 96 feet by 15 1/2 feet, and the bed working width is 60 feet by 36 inches, with additional open area between carriage uprights for work widths up to 48 inches. Design of the machine is such that any required width and length can be supplied.

Circle Item 101 on postcard, page 223

Onsrud electronically controlled milling machine for wing components features double-carriage design.

IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

Tape-Controlled "Fosmatic" Jig-Boring Machine

The Fosdick Machine Tool Co., Cincinnati, Ohio, has brought out a tape-controlled "Fosmatic" jig borer to facilitate the practical application of this type of precision machine to small and medium-size production runs. With this jig borer it is possible to machine work to very close tolerances without the use of special jigs and fixtures. The machine does not require a highly skilled operator since it performs automatically the functions that formerly taxed the operator's skill.

The operator simply loads the part to be machined on the table of the jig borer and presses a button. The machine automatically positions the table within accuracy limits of ± 0.0001 inch and sets the spindle speed and feed to the values punched in the tape. The control tapes are prepared in the engineering department where the most efficient order of operations is determined and programmed. Dimensions from part prints are punched directly into the tape without the need for coding since a decimal tape punch is used.

Tools are set in the toolroom and numbered according to the operations program. The operator simply follows the program, thus eliminating another opportunity for human error. Additional benefits claimed for the tape-controlled jig borer are: reduction of scrap; elimination of costly jigs; and speedier operation. Tapes are usually stored away so that production runs of any part can be accurately duplicated at any time.

The measuring system allows the table to be positioned automatically to tolerances of ± 0.0001 inch. A series of Class A measuring gages are lined up for meas-

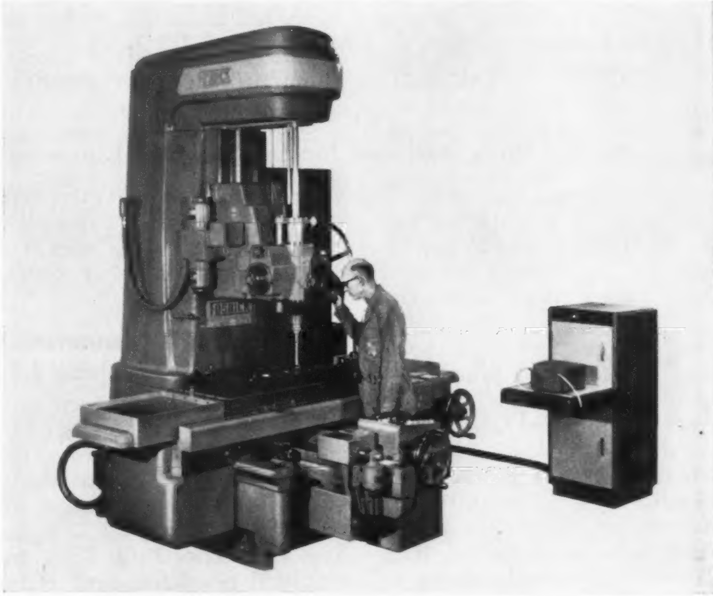


Fig. 1. "Fosmatic" tape-controlled jig borer that allows complete programming of table positions and spindle feeds and speeds.

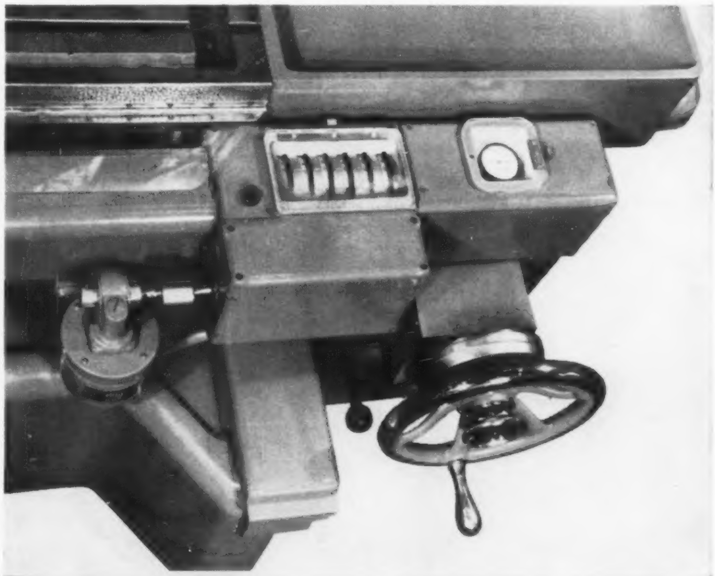


Fig. 2. Drum dials on which table position measurements are set have been motorized on the "Fosmatic" tape-controlled jig borer, built by the Fosdick Machine Tool Co.

urements along X and Y coordinates. There are four gages in even tens of inches, ten in inches, ten in tenths of inches, and so on down to increments of 0.0001 inch. The gages are selected by motor-driven drum dials and positioned end to end to provide the required measurements.

Movement of the table serves to stack the gages and cause them to operate a switching mechanism. At the final positioning point, the table movement is stopped, the traverse screw is relieved by a slight reversing movement, and the table is clamped.

The "Fosmatic" jig borer Model 54P provides sixteen speeds ranging from 30 to 1800 rpm which are controlled by electromagnetic clutches. Eight different feed rates within the range of 0.0005 to 0.010 inch per minute can be selected. The table is 54 by 22 inches and has a table-to-spindle capacity of 27 1/2 inches.

Circle Item 102 on postcard, page 223

Minster Press Designed for Single-Stroke Efficiency

A press design feature developed by the Minster Machine Co., Minster, Ohio, is said to provide a higher single-stroke efficiency (based upon rated continuous press speed) and the widest speed selection ever available on large double-geared straight-side presses. This design, applied and tested in Minster MS2 presses operating on automotive production lines, incorporates Minster's patented intermediate shaft combination air-friction clutch and brake drive arrangement. It is claimed that several features of the drive make it possible for users to obtain faster starting and stopping and more single-stroke operations per minute with decreased wear and less clutch maintenance.

The Minster air-friction clutch and brake unit is located on a slower turning intermediate shaft instead of within the flywheel on the high-speed drive-shaft. The user may select either the faster speeds of a conventional single-geared machine or the slower speeds of a double-geared press.

Minster MS2 presses are of the four-piece, tie-rod box type frame construction designed for maximum rigidity and have a recirculating oil lubrication system which provides a continuous oil film on all bearing surfaces. All air, lubrication, and electrical systems are enclosed within the press frame. These presses are available in capacities ranging from 150 to 500 tons.

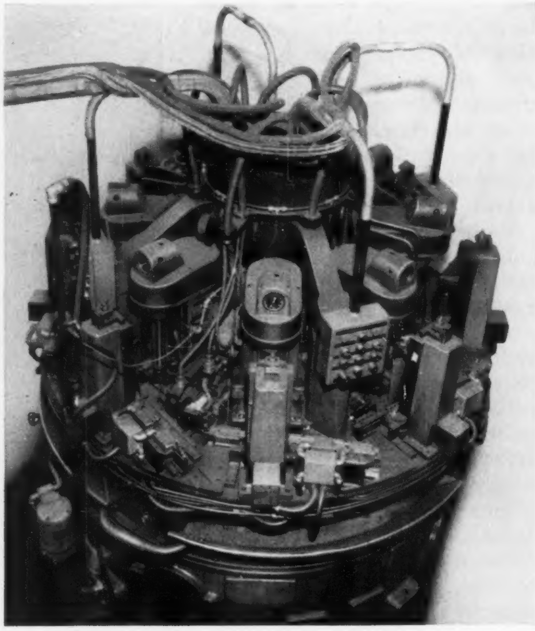
Circle Item 103 on postcard, page 223

Douglas Automatic Machine for Precision Shaping Jet-Engine Blades

High-production precision machining of steel and titanium jet-engine blades is accomplished on an eight-station, automatic shaping or milling machine developed for the Air Force by the Douglas Tool Co., Hazel Park, Mich, In simulated production runs, eight blades 10 inches long and 3 inches wide have been profile-machined in ninety minutes. Fully loaded with thirty-two blades, the machine runs for six hours without manual attention other than the removal of finished blades from the magazine.

Each of the eight heads involves control of three specific

Press designed for high single-stroke efficiency developed by the Minster Machine Co.



Eight-station automatic machine for processing jet-engine blades developed by Douglas Tool Co.

movements: hydraulic down feed of the cutters; hydraulic drive of the milling head; and rotation of the work-holding chuck. Coordination of these three movements is controlled by an electrical computer which picks up its signals from a master cam that is an exact enlarged version of the actual blade being milled. The feeding rate of the cutter is maintained constant in relation to the blade. As the blade contour changes and the blade becomes wider, work chuck rotation slows automatically to maintain a constant surface speed and chip load. Chuck rotation increases at the leading and trailing edges of the blade to compensate for change in dwell time.

Contour-milled blades require no grinding, polishing being sufficient. The Douglas "Hi-Helix" carbide contour-milling cutters used provide excellent finish and long tool life. The finish ranges from 75 to 90 micro-inches. Up to 0.100 inch of stock is removed while milling the blades. Cutters are 3.75 inch in diameter, and up to 3/32 inch can be removed by sharpening. An unusual feature of the machine is that the cutters do not have to be matched to exact diameters. After checking diameters, dial settings on an electrical control panel automatically compensate for any difference in size up to 0.080 inch.

Circle Item 104 on postcard, page 223

Gisholt Masterline Lathes Equipped with JETracers Speed Jet Disc Production

Masterline center-drive lathes built by the Gisholt Machine Co., Madison, Wis., for Pratt & Whitney Aircraft, East Hartford, Conn., machine both sides of a jet-engine compressor disc simultaneously in 181 minutes. This represents a reduction in machining time of 100 minutes per disc from the time consumed by methods previously employed. It is claimed that a finer degree of accuracy is obtained with the new machines.

The lathe shown in Fig. 1, equipped with Gisholt JETracers, is set up for machining both sides of jet-engine compressor discs 28 inches in diameter, which have a web thickness of 0.115 inch. Tests in machining discs of this size have indicated that the lathe can hold the center base and the snap-ring diameters to an accuracy within 0.001 inch. Discs have been machined, under production conditions, to a web thickness of only 0.080 inch and, experimentally, down to 0.007 inch, as shown in Fig. 2. Parallelism with the bore, outside diameter, and the two faces of the work is held to 0.0008 inch on the 14-inch radius.

The lathe is designed for heavy-duty rough machining operations on either stainless steel or titanium jet discs up to 28 inches in diameter, as well as for finishing the discs to the extremely close tolerances required. Its main advantage, however, is its capacity for machining both sides of the disc simultaneously, using a four-pass Gisholt JETracer on each side. This method serves to equalize machining stresses and eliminate inaccuracies that were un-

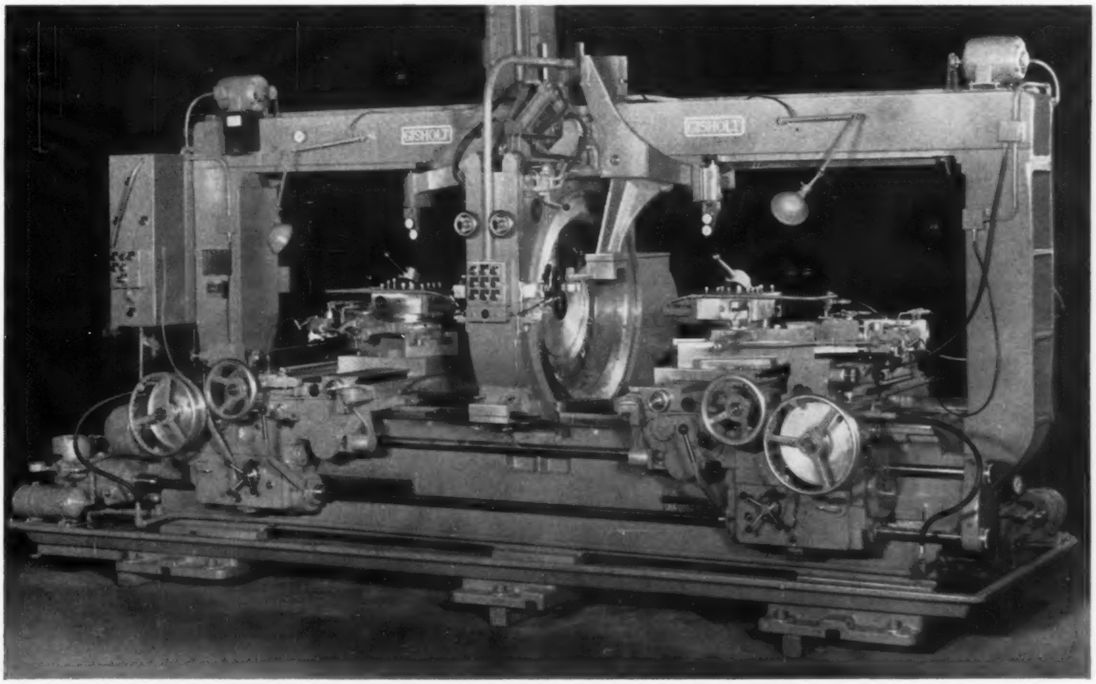


Fig. 1. Gisholt Masterline center-drive lathe equipped to machine both sides of jet-engine compressor discs simultaneously, using JETracer to produce difficult contours with a high degree of accuracy.

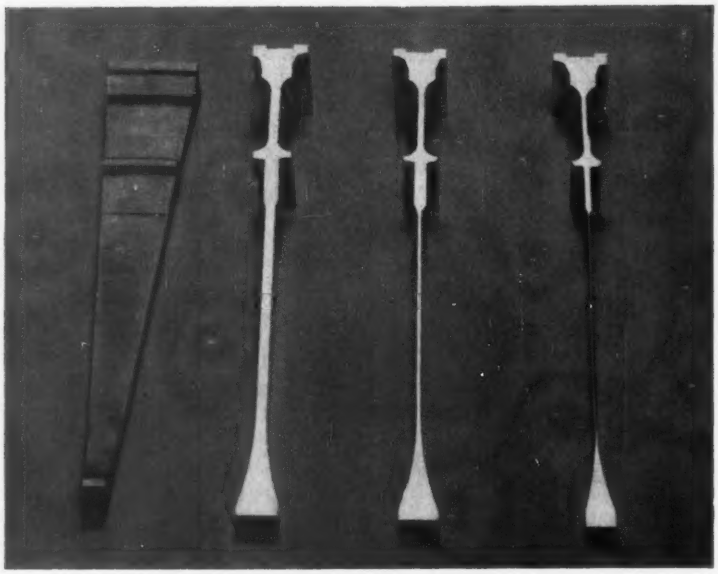


Fig. 2. Sections of jet-engine compressor discs showing contours and web thickness. (Left to right) front view showing contour; edge view of 0.115-inch web; edge view with 0.080-inch web; and edge view with 0.007-inch web.

avoidable with the chucking and machining methods previously employed. Templates govern the movements of the roughing and finishing tools, separate templates and tools being used for roughing and finishing cuts.

The machine, as seen in Fig. 1, consists primarily of a bed with a center driving unit and overhead support. An overhead bridge carries two longitudinally movable arms with work-support rollers. One of these arms is shown in Fig. 3 with its roller contacting and supporting the work on a previously faced hub. A similar roller also supports the work-piece from the left-hand side, thus preventing any longitudinal movement or distortion of the work during the contour facing operations. A second pair of pivoting arms, operated by hydraulic cylinders, carry indicators used to accurately position the tools for the close-tolerance facing and boring operations.

Bedways extending to the left and right of the center driving unit support independent side carriages, each complete with a bridge type cross-slide, a JETracer slide, and a turret-type toolpost. Each cross-slide has a four-position indexing drum to carry tracer templates which permit up to four passes over the work. The lathe is powered by a 60-hp, variable-speed motor arranged to rotate the center driving unit in either direction and at a varying speed to provide constant surface speed for the cutting tool.

Circle Item 105 on postcard, page 223

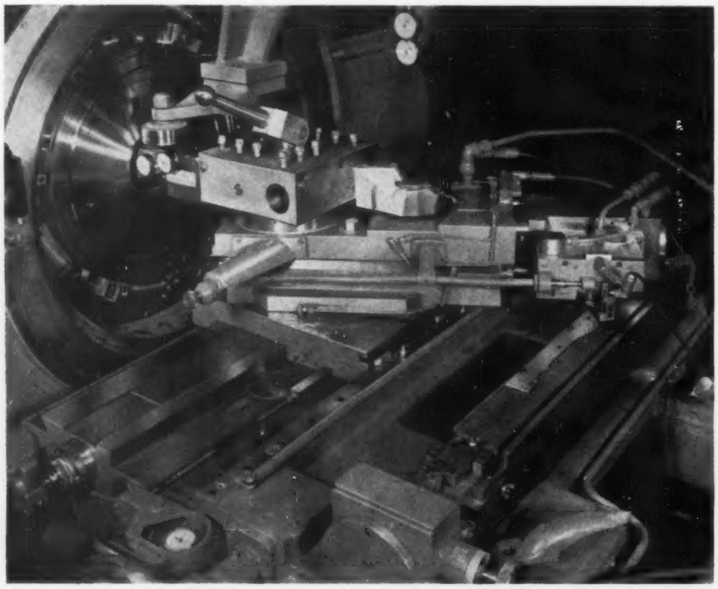


Fig. 3. Close-up view showing how the cutting tool of machine shown in Fig. 1 is accurately positioned for the boring cut. Note roller support to the disc, JETracer slide, and four-position tracing template carrier with template.

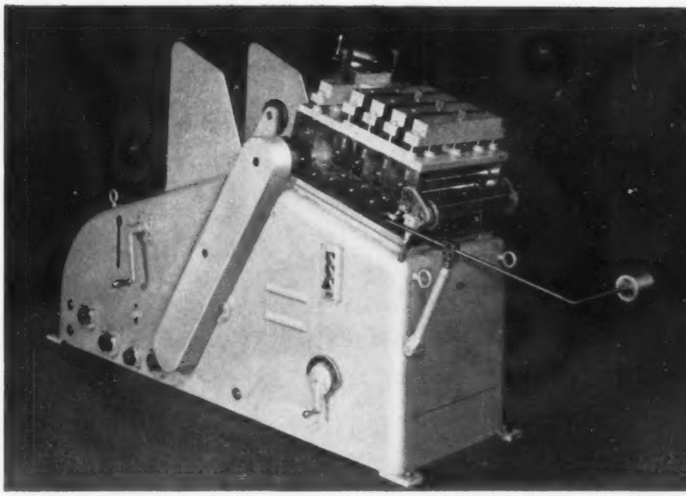
Framework for Supporting Direct-Connected "Regulex" Motor-Generator Sets

A compact and versatile framework for supporting direct-connected "Regulex" motor-generator sets used with arc furnace control on electrode motors 10 hp or larger has been developed by the Allis-Chalmers Mfg. Co., Milwaukee, Wis. Each framework is of welded-steel construction with space for two motor-generator sets. If floor area is at a premium, the two frames housing three or four "Regulex" motor-generator sets can be mounted on top of one another. The fourth set then serves as a convenient spare for three-phase furnace operation.

Where overhead space will not permit use of four motor-generator sets located on top of one another, each of the two frames can be placed on the floor. Flywheels mounted between the motor and generator retain enough momentum to lift the electrodes from the metal in the furnace should power fail.

Circle Item 106 on postcard, page 223

Power-Driven Straightener and Coil Cradle



Power-driven straightener and coil cradle built by U. S. Tool Company, Inc.

A combination power-driven straightener and coil cradle suitable for material up to 16 inches in width, in coils with outside diameters up to 48 inches, has been brought out by the U. S. Tool Company, Inc., Ampere, N. J. The cradle is equipped with four power-driven rest rolls, one idler rest roll, and one bumper roll.

The straightener has eight hardened and ground straightening rolls (lower four power-driven); indicators on upper rolls; and two hardened and ground power-driven take-in rolls. This unit is equipped with a loop control mechanism and a 3-hp Vari-Speed motor for output speeds from 26 to 76 feet per minute for operation on 220/440-volt, three-phase 60-cycle alternating current circuits.

Circle Item 107 on postcard, page 223

Hamilton Presses with Sliding Bolsters and Pre-Set Dies

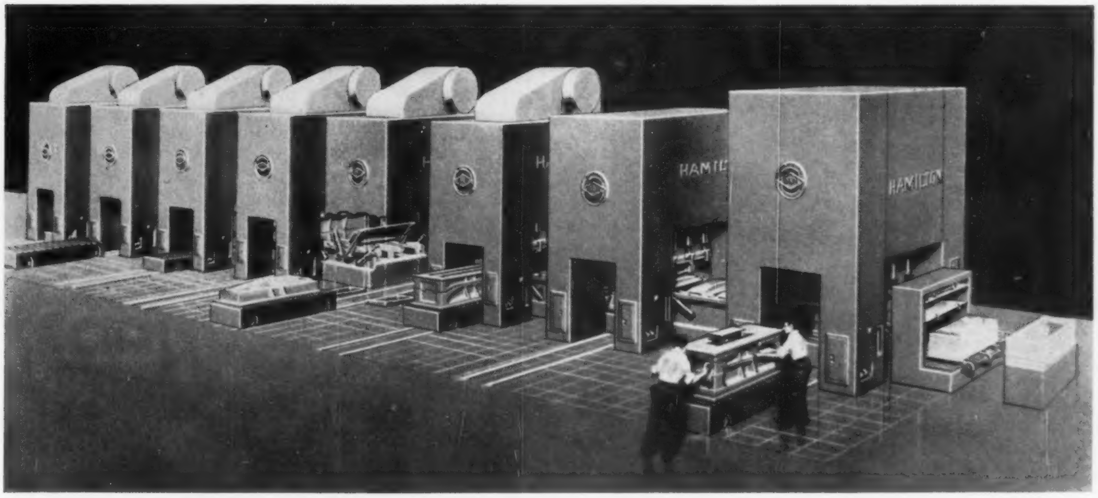
Sliding bolsters and pre-set dies are features of a new press development brought out by the Hamilton Division, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. This development, designed primarily for high production on short runs, can be applied to a single press unit or to groups of presses and is applicable to all sizes and types—single- or double-action; top or bottom drive; and one-, two-, or four-point types. It is recommended for use on highly automated production lines.

Although the design has previously been used by the manufacturer for die spotting presses, the sliding bolster is a new development for presses performing production operations such as blanking, drawing, and forming, and is said to have many possibilities in the automotive, aircraft, and appliance industries, as well as in general jobbing shops which produce miscellaneous parts.

As little as five minutes need elapse between the end of one production run and the start of another using a new die. When a press run is completed, the die is removed on the sliding bolster. A new die, set up on the second sliding bolster while the press is in operation, is slid into the press for a new production run.

The time required to remove a die after the bolster is in the open is only a matter of minutes. Com-

(Continued on page 204)

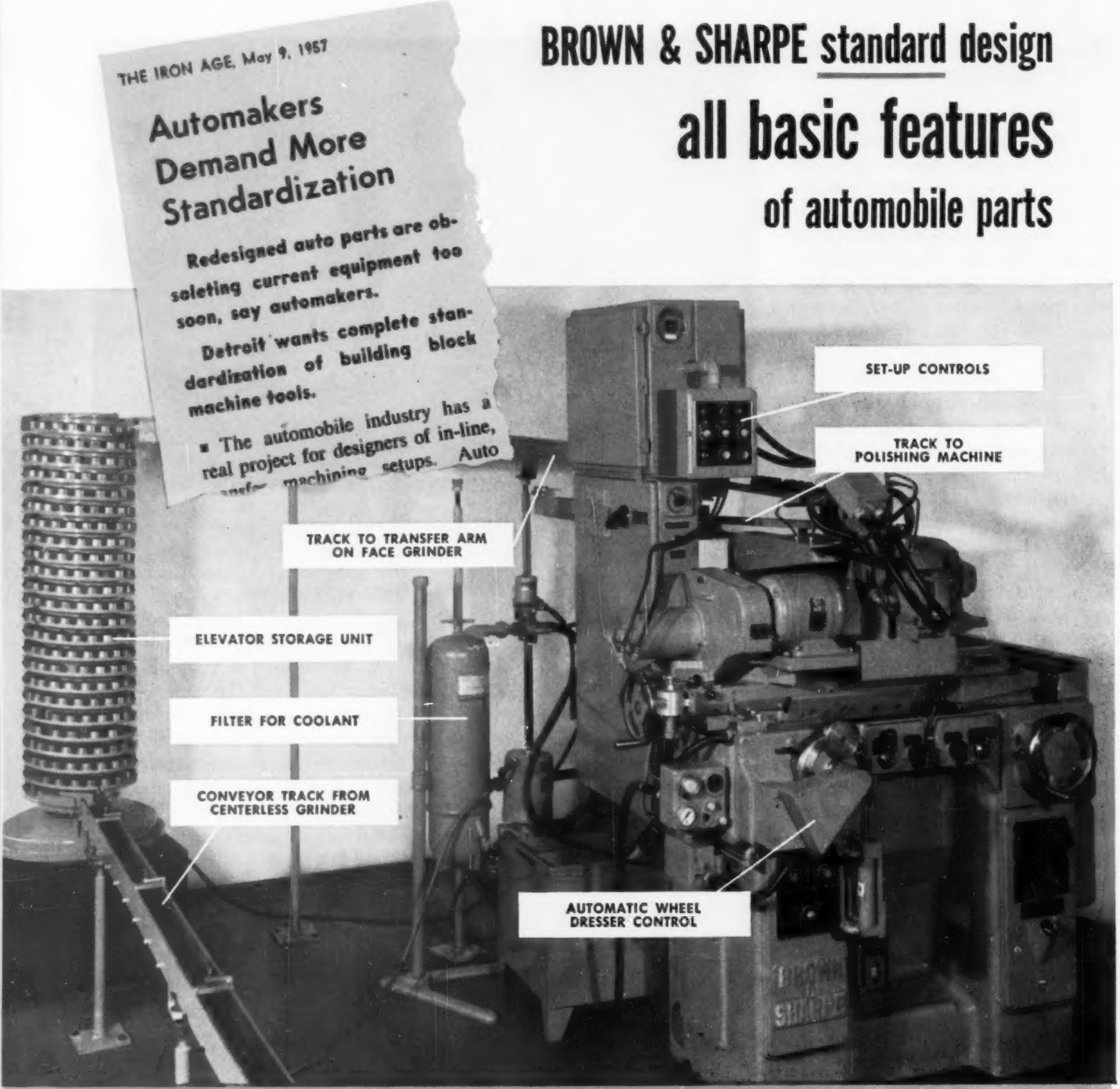


Typical line of presses equipped with sliding bolsters that cut die change time developed by Hamilton Division of Baldwin-Lima-Hamilton Corporation

BROWN & SHARPE standard design

all basic features

of automobile parts



- **No. 11 FACE GRINDING MACHINE** is used in a completely automated production line, between centerless grinding and polishing operations.
- **OPERATION** is grinding one face of cylindrical parts for a power steering mechanism.
- **AUTOMATIC CYCLES** and work-handling equipment eliminate manual operations. Grinding, wheel-dressing, work loading and unloading are fully automatic. When grinding wheel is reduced to minimum usable diameter, the machine automatically stops, for replacement of the wheel by the operator in charge of the machine.
- **SPECIAL TRANSFER ARM** (left) has two chambers, swings down to unload finished part into one chamber, and load chuck with

MILLING, GRINDING, AND SCREW MACHINES • CUTTERS
MACHINE TOOL ACCESSORIES • PRECISION TOOLS • PUMPS

of the No. 11 Face Grinder provides
needed for FULL AUTOMATION
production at Thompson Products

Rapid and costly obsolescence of special machines can be avoided when you start with a *standard* machine that permits designing for any degree of automatic operation.

At Thompson Products, the No. 11 Face Grinding Machine (left) is completely automated, with the addition of special automatic cycles and work-handling equipment, for grinding power steering parts. Production rates meet full demand for a leading automobile manufacturer.

If specifications should be changed, or if the part is eliminated, the machine can be reconverted for revised special requirements, or for standard use, without major expense.

The basic standard features of the No. 11, so readily adaptable for automatic operation, are your assurance of top production on the wide variety of work it handles without special equipment, like the gear face grinding operation (right) at New Process Gear Corp.

For maximum diamond and wheel economy, automatic control of wheel-truing is an available feature of the No. 11 Face Grinder. The operator is relieved of this responsibility, eliminating the possibility of waste, and extending production time between wheel changes.

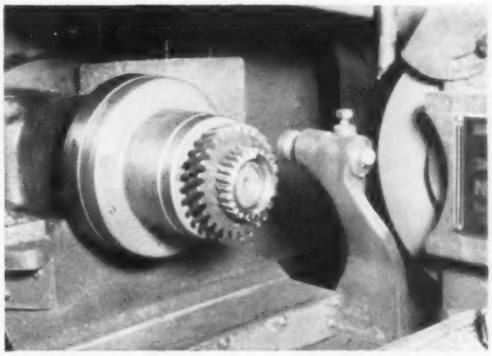
Brown & Sharpe design specialists will survey your grinding operations at your request. Let them show you how to make your machine investment pay the highest return . . . in productivity, in lasting economy. Write: Brown & Sharpe Mfg. Co., Providence 1, R. I.

Speeds production, lowers cost on jobs requiring standard features only

Grinding the face of these transmission gears, at New Process Gear Corp., is typical of hundreds of jobs for which the No. 11 is quickly adaptable, without special equipment, employing only the standard features, which permit a semi-automatic grinding cycle and set-diamond wheel dressing control. One man operates two machines, at 85% shop efficiency. His total production, from both machines is 126 pieces per hour.

unground part from other. At top of travel, the arm ejects finished part into track leading to next operation, and loads unground part, for transfer to chuck. Chuck is flushed with filtered coolant after each unloading.

- **AUTOMATIC PRESET GRINDING CYCLE** includes rapid advance, wheel feed, spark out, and rapid retraction.
- **AUTOMATIC DIAMOND IN-FEED** and size compensation for wheel restrict wheel-dressing to preset intervals and amount, avoids excessive dressing.
- **PRODUCTION RATES** up to 300 pieces per hour are obtainable, depending on material, stock removal, and finish specifications. Work-loading time is about 4 seconds, which is overlapped by wheel-truing time.



The home of PRECISION CENTER

Brown & Sharpe BS

For more information fill in page number on Inquiry Card, on page 223

pared to two hours change time for a conventional press, normal time required to change dies on the outboard bolster is one-half hour—a reduction of 75 per cent.

Each press has two bolsters independently actuated by pushbuttons which control the motor drive in the press base. The bolsters also can be powered by motor-driven winches. Bolster movement can be independent or simultaneous, as required. The bolsters travel through the press sides rather than the fronts or backs—essential for a line of presses, particularly an automated line. They can also go through the front or back of a single press when required.

During die loading, the bolster is completely clear of the press framework. Crane action is not obstructed by the press body or framework. After loading, the bolster partially slides back into the press framework, reducing the amount of floor or aisle space needed.

Circle Item 108 on postcard, page 223

Turret Press with Automatic Material Handling

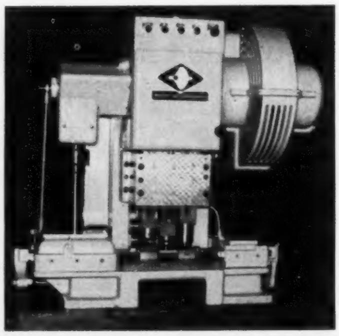
Automatic material handling has been designed into a turret punch press built by the Wiedemann Machine Co., Philadelphia, Pa., for a manufacturer of steel doors. The machine cuts out openings in 16- to 18-gage sheet for light panels, doorknobs, strikers, hinges, and sash. Each door consists of a sandwich of two matching sheets and a filler material. Dimensions and hardware details vary from door to door, so producing them on a turret punch press proves highly practical.

The press, rated at 40 tons, is run by one man. Operation of the material-handling mechanism is shown in Figs. 1 and 2. Sheets are brought on a dolly to the side of the press. In Fig. 1, a sheet is shown about to be lifted from the dolly. The mechanism—a Littell suction unit suspended from a gate type hoist—will raise the sheet, where it will hover while the previous sheet is being punched.

In Fig. 2, the previous sheet has been completed and is shunted to a stacking table, seen in the foreground. Upon signal from the operator, the hoist transfers the new sheet to the front of the press, then retracts to its original position.

Other interesting material-handling features include a row of "disappearing" rollers in front of the turret, which support the work as it moves in or out of the press throat, and a scrap receiving system on the right-hand side of the machine. There is a chart drum which gives the operator coordinates of the work position for each turret station. Work clamps and indexing pins are air-operated. In addition to the savings in manpower over the user's previous method of fabricating the doors, an income of $7000 yearly is anticipated from the light panel scrap, which is now of a reclaimable size.

Circle Item 109 on postcard, page 223



Impact forming machine built by the Multi-Autoform Corporation

Multiple Ram Impact Forming Machine

An impact forming machine featuring built-in automation has been designed and built for the manufacture of simple or complex metal stampings by the Multi-Autoform Corporation, Glendora, Calif. This machine employs modular designed plug-in tooling featuring standard elements which greatly simplify die construction. Substantially reduced setup time requiring minimum skill to tear down the dies used for a preceding run and install tooling for a new job is a feature claimed for this machine. Another advantage is the high rate of production obtainable which is adjustable be-

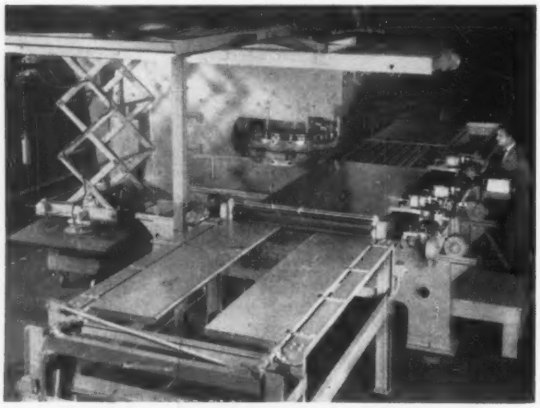


Fig. 1. New sheet to be punched is ready to be picked up by lifter at side of press.

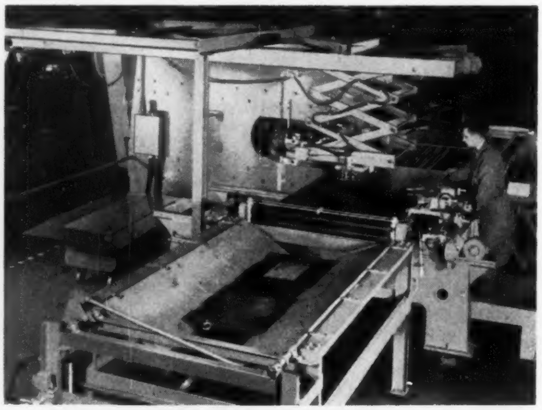


Fig. 2. Punched sheet drops into stacking table in foreground while new sheet is transferred to press.

JONES & LAMSON
MACHINE COMPANY

the man who needs
a new machine tool is
already paying for it

Blessed Event, Plant-Style

They're passing out cigars in the front office. And here on the delivery platform, the production V.P. is on hand personally to welcome the new arrival . . . a J & L Turret Lathe.

Beaming grins like his can be seen throughout the plant, and with good reason: everyone figures to benefit from this new equipment. The operator's job is made easier, and his opportunities for increased compensation are better. Production management can start right away on those new production estimates, and begin planning further improvements. Top management knows that the competitive position of the company is stronger. And right down the line, that profit-sharing plan looks sweeter than ever.

Is *your* company benefiting from the increased production and added versatility offered by advanced J & L equipment?

If not, *why* not? We offer a variety of liberal finance plans, and we'd like to give you all the details. Write today.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

For more information fill in page number on Inquiry Card, on page 223

tween 250 and 800 parts per minute, regardless of how small or large the lot run is. This speed is made possible by the built-in automated transfer mechanism which eliminates the need for constant attendance by an operator.

Circle Item 110 on postcard, page 223

P & W King-Size Precision Measuring Machine

The Pratt & Whitney Co., Inc., West Hartford, Conn., recently shipped a 12-foot precision measuring machine to the Aircraft Gas Turbine Division of the General Electric Co., Evendale, Ohio. This machine, with a measuring capacity of 144 inches, as compared with P&W's longest standard model of 80 inches, is the largest of its kind made by this company. It reads to 0.00001 inch with controlled measuring pressure.

The machine consists essentially of a master bar, measuring head, and Electrolimit tailstock, all mounted on a rigid bed. The master bar is made in three sections and has 144 stainless steel measuring bar buttons. Each button carries a finely drawn hair line exactly 1 inch from the lines on adjacent buttons. The hair line is visible through an attached 75× microscope and is used for setting precisely each inch of length according to the length required on the part to be inspected.

The headstock is direct-reading and will repeat to 0.00001-inch accuracy. The measuring screw has a precise 1-inch travel and the graduated dials include a vernier graduated to 0.00001 inch. Pressure control through the Electrolimit tailstock is essential in obtaining precise readings. The tailstock is graduated to provide pressure controls from 1 to 2 1/2 pounds.

Circle Item 111 on postcard, page 223

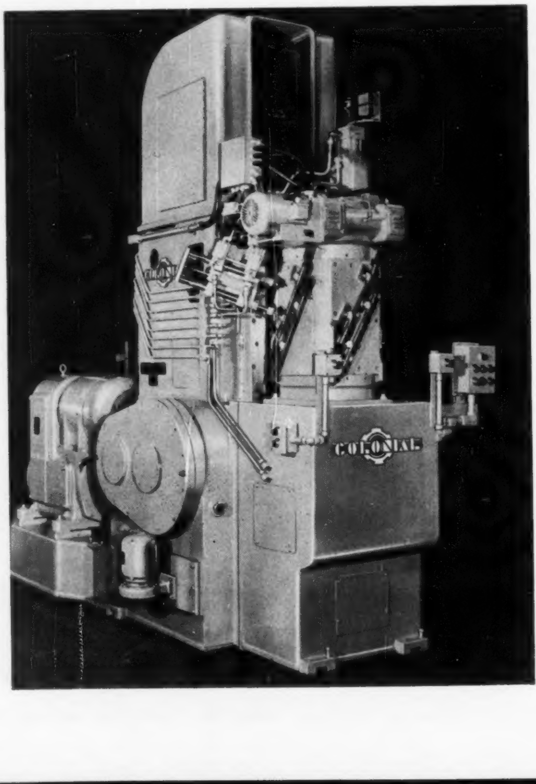
Colonial Vertical-Chain Surface-Broaching Machine for Cutting Oil-Groove Slots

Eight oil-groove slots in an automotive rocker-arm shaft are automatically broached at a rate of 640 per hour at 80 per cent efficiency on a 10-ton, 160-inch stroke vertical-chain surface-broaching machine equipped with a four-station indexing fixture built by Colonial Broach & Machine Co., Detroit, Mich. The shafts are manually loaded, automatically probed for true position, broached, and automatically ejected in a cycle time of nine seconds. All movements are actuated by a special hydraulic circuit interlocked with the machine circuit for full service operation.

Predrilled shafts are loaded, two at a time, in a retaining fixture on the indexing face. The part is preliminarily held on pins in conjunction with a spring-loaded plunger. Positive holding action is accomplished at the cycle start by automatic clamping

(Above) Pratt & Whitney precision measuring machine of exceptionally large size

(Below) Eight oil-grooves are cut in each of two rocker-arm shafts at one time in this unified broaching setup developed by Colonial Broach & Machine Co.



For more information fill in page number on Inquiry Card, on page 223

of two hydraulically operated wedges. At the first indexing station, both parts are probed for correct hole locations by hydraulically operated probe units. If improper positioning occurs, the machine automatically shuts off until the part is repositioned.

At the broaching station, the eight oil-grooves and an identification notch are broached in one pass at a speed of 35 feet per minute. The grooves are angularly cut at 30 degrees to a radial depth of 0.06 inch. The parts are automatically unloaded at the fourth station by air ejection.

The indexing fixture is of the worm and worm-gear type. The index drive is by a 1 1/2-hp, 1200-rpm motor through an electromechanical clutch. Accurate positioning is held by a hydraulically operated shot-pin that engages a four-position index-plate. The main drum is guided on taper roller bearings at top and bottom.

Circle Item 112 on postcard, page 223

Bliss Gap Press Designed to Pierce Fender

Piercing automobile rear fenders is the job of two custom-built gap frame presses recently designed and built by the E. W. Bliss Co., Canton, Ohio. These 200-ton eccentric-driven, single-action presses have a one-piece frame and built-in accessories.

Other features include pneumatic friction clutch and brake, slide arranged for three-bar knockout, electric push-button control, stroke indicator, die cushions, die lights, safety jacks, and rotary synchronizing switch. In addition, an automatic filtered oil lubrication system for the entire press including ram gibs and cushions is provided.

"Packaged" presses of this design can be built with shafts front to back or left to right, with oil or grease lubrication built in or not built in, and they can be had in single- or double-geared type.

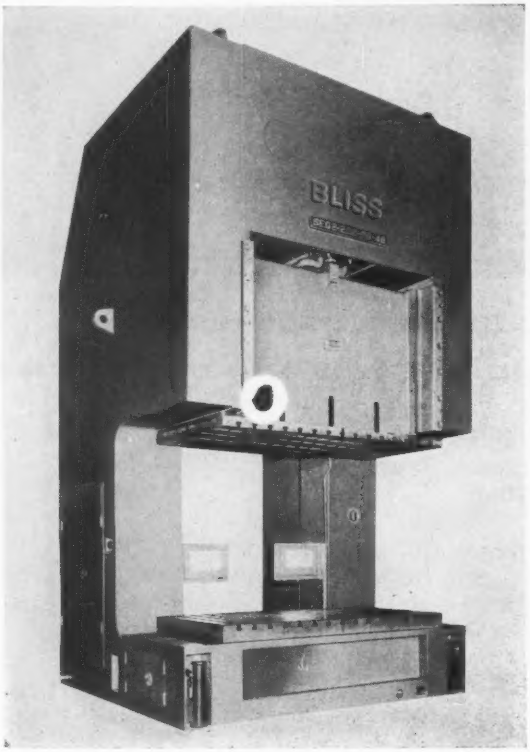
Circle Item 113 on postcard, page 223

Jig Borer with Optical Setting Devices

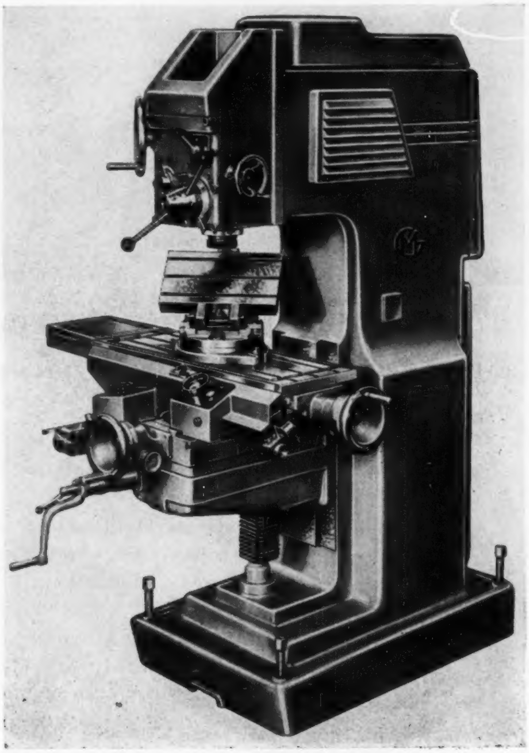
The Model 35-NC jig borer manufactured by G. Matheys, Brussels, Belgium, and introduced in this country by the Triplex Machine Tool Corporation, New York City, has the work-table designed for positioning longitudinally and crosswise in accordance with readings to 0.0001 inch by optical setting devices that scan precision scales located in the saddle and knee. The table is 33 1/2 by 12 inches, and has movements of 21 1/2 by 12 1/4 inches. The lead-screw nuts are adjustable for the elimination of wear.

The spindle is driven by a 2 1/2-hp, alternating-current motor. Infinitely variable spindle speeds range from 96 to 1720 rpm. The spindle has a No. 30 ASA taper and quick-acting tool retainer nut. Power feed at three rates is provided for the 5 1/2-inch boring depth.

The machine can be equipped



Gap press for piercing automobile rear fender built by the E. W. Bliss Co.



Matheys jig borer distributed in this country by the Triplex Machine Tool Corporation

JONES & LAMSON MACHINE TOOLS

the man who needs
a new machine tool is
already paying for it

Now — a machine that turns, bores and faces with great accuracy . . . at truly low cost

The new Jones & Lamson Precision Boring Machine may very well be just what *your* production operation needs. This new machine performs turning, boring and facing operations accurately, speedily and economically. Here it is shown on the job at Olson Mfg. Co., Worcester, Mass., turning, facing and boring electronic parts, in lots of 4000 to 6000 pieces. Two O.D.'s are held to .0005", and two bores to .0002". Concentricity between the bores, I.D.'s, and faces, is held to a total of .0008", at high production rates.

The J & L Precision Boring Machine is ideal for both long and short runs . . . is extremely versatile . . . is easy to set up . . . and spindle runout is less than .000020". Maximum swing is 10" dia., and maximum bore is 3" dia. Single or double spindle; push button cycling, manual or automatic.

Write for complete details. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

For more information fill in page number on Inquiry Card, on page 223

with coolant system, machine light fixture, optical centering device, and a variety of vises and other work-holding devices.

Circle Item 114 on postcard, page 223

Power Pack Attachment for Lincoln Idealarc Welder

The Lincoln Electric Co., Cleveland, Ohio, has announced a power pack attachment for its 500-ampere, combination alternating- and direct-current Idealarc welder, which permits use of the welder as a power source for the manual Lincolnweld, ML-2, semi-automatic submerged arc welder.

The combination of the Idealarc welder, the ML-2 submerged-arc welder, and the power pack make a package capable of manual welding with direct or alternating current, and submerged-arc welding with direct current. The Idealarc operates on single-phase input power. Generator power sources for the ML-2 submerged-arc unit require three-phase current.

Circle Item 115 on postcard, page 223

BarnesdriL Liquid Sizing for Automatically Gaging Honed Bores

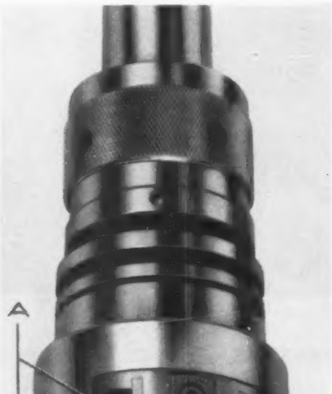
An improved method for sizing honed bores as a part of the honing cycle has been announced by the Barnes Drill Co., Rockford, Ill. This method, referred to as Liquid Sizing, automatically gages the diameter of honed bores throughout their full length as honing progresses. Actual sizing is accomplished by metering liquid directed against the cylinder wall, through orifices A, Fig. 1, in the honing tool, until it reaches a pre-selected pressure.

As shown diagrammatically in Fig. 2, the BarnesdriL Liquid Sizing system supplies coolant at a constant pressure to both the tool and the master gage. Back pressure, created by forcing coolant between the tool and walls of the cylinder, affects the expansion of the bellows. As honing progresses, the distance between the tool and the wall increases, causing back pressure to decrease and the bellows to expand, until the point is reached where this variable pressure balances the pre-set pressure on the master gage. At this point, a micro switch is tripped to conclude the honing machine cycle, with the honing tool continuing for one full additional stroke. If at any point the bore is not to size, the micro switch reactivates the cycle, and honing continues until the entire bore is to size.

Liquid Sizing offers several advantages not found in other methods of gaging honed bores. Coolant is flooded over the cylinder walls at the most critical point during the honing cycle, thus better heat control is effected. This also provides continuous flushing which increases the stone life and provides better micro-finish control. New BarnesdriL plate type honing tools are used in applying the new method to facilitate replacing stones.

Circle Item 116 on postcard, page 223

(This section continued on page 212)



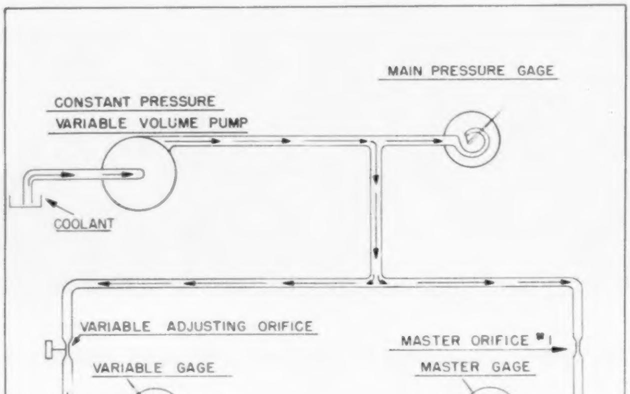
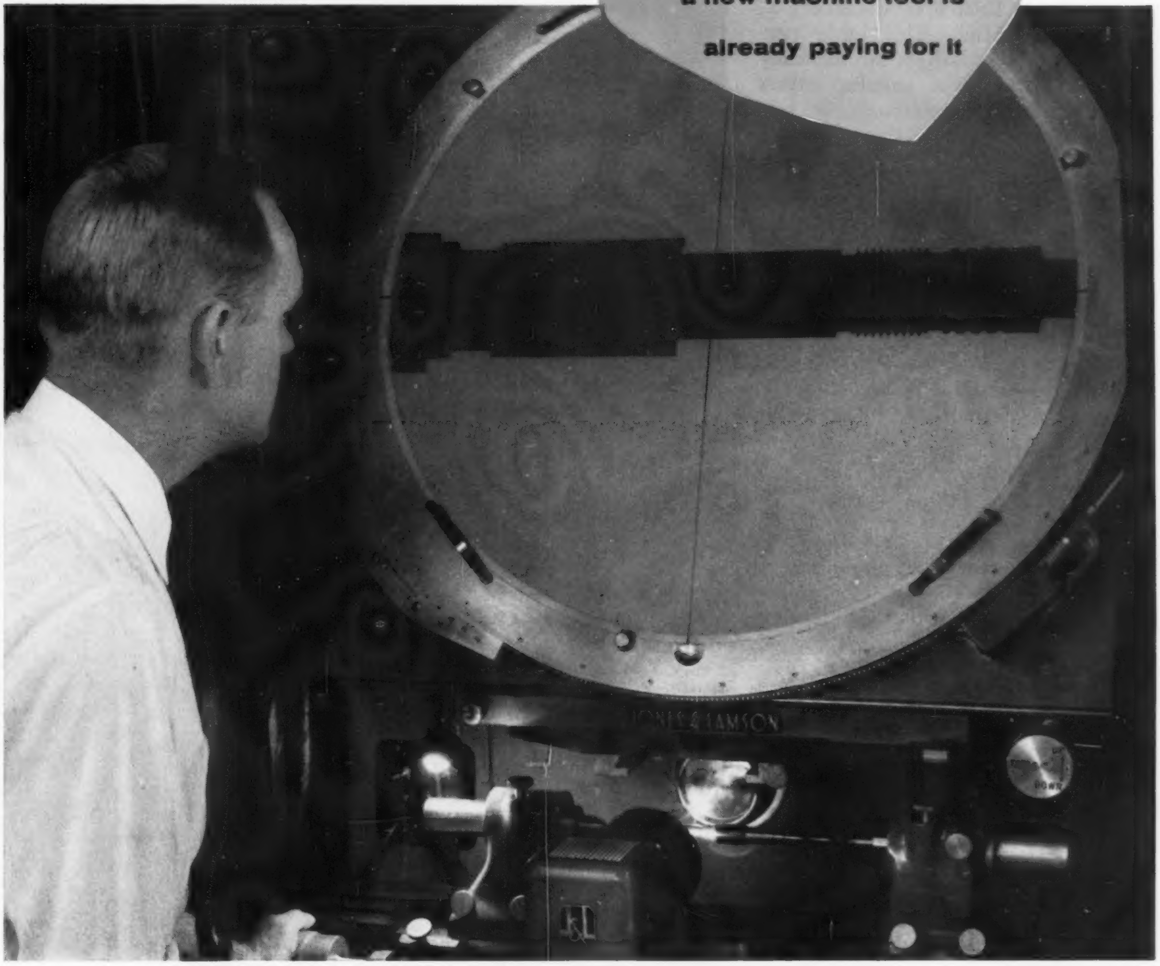


Fig. 1. (Left) BarnesdriL plate type honing tool showing orifices (A) from which coolant is metered for automatic sizing. Fig. 2. (Right) diagram illustrating its operation.

JONES & LAMSON
OPTICAL COMPARATORS



Inspections formerly "Impossible" are now done at a glance

Not so very long ago, the quality control inspection of intricate parts was a mean, painstaking job. It called for a number of gages, lots of computations, a good sense of "feel" and, in many cases, sheer instinct. Even then, there was a margin for error.

Things are quite different now. Take this application, for example. The piece being inspected is a precision gear shaft. Its oil grooves, shoulder lengths and several diameters, as well as the lead, pitch diameter and thread angle of its thread and worm are *all* inspected in *one simple operation* by a Jones & Lamson Optical Comparator. And the inspection is precise, to .0001″.

The speed, accuracy and versatility of J & L Comparators could very well improve *your* production. Write for our latest Comparator Catalog. JONES & LAMSON MACHINE COMPANY, 512 Clinton St., Springfield, Vermont.

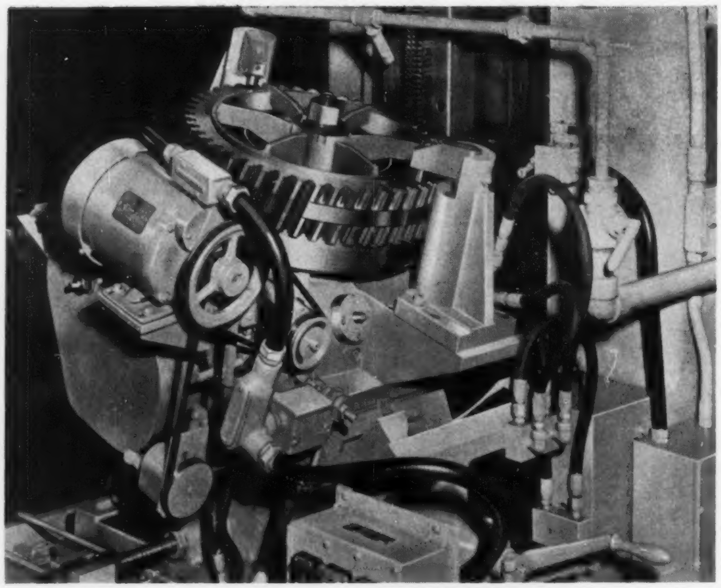
Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

For more information fill in page number on Inquiry Card, on page 223

Colonial Indexing Table

An indexing table for positive positioning of parts to 0.0001 inch has been developed by the Colonial Broach & Machine Co., Detroit, Mich. This table permits no backlash; is mechanically self-locking; has angular setting (by cradle mounting); is infinitely variable within a broad index range; and is highly flexible. Although originally built for horizontal broaching machines, the basic patented design has proved so versatile that the table is now available as a unit for use on a broad range of machine tools. It is particularly suited for jet-engine, turbine, missile, or similar high-precision production work.

The machine is available in diameter capacities of 11, 18, and 28 inches, all offering an infinitely variable indexing range of from 21 to 250 divisions of a circle. Rotation occurs only during indexing when the opposed control worm allows the driving worm to move. A continuously running motor does double duty, providing the indexing power and taking up all backlash in the unit through two slip type clutches. All gears lock when the index-pin is located in the plate.



Indexing table developed by Colonial Broach & Machine Co.

Circle Item 117 on postcard, page 223

General Electric Magnetic Motor Starter

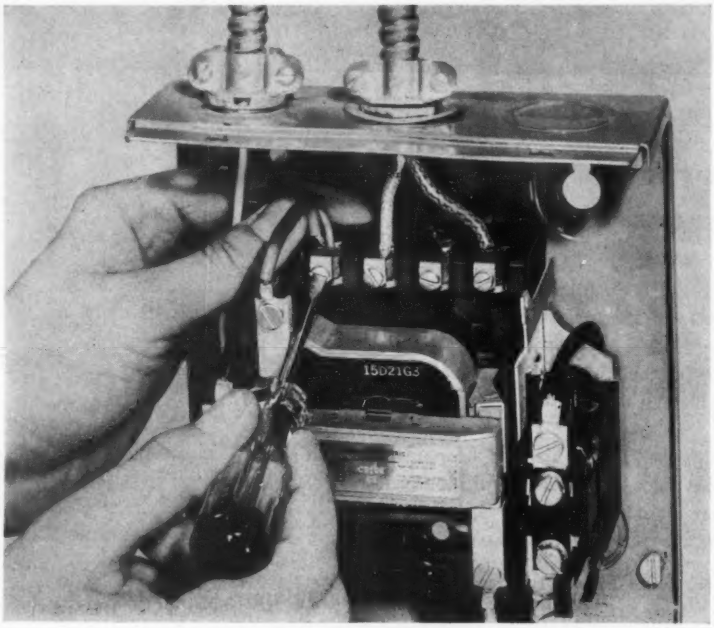
A new NEMA size 0 and 1 magnetic motor starter that is 42 per cent smaller than previous open forms has been developed by the General Electric Company's General Purpose Control Department, Schenectady, N.Y., for such applications as machine tools, pumps, hoists, blowers, saws, compressors, and mixers.

Radically different in design, the starter is of "snap-slide" construction. Principal components simply snap or slide together for quick inspection and maintenance. Contacts can be inspected in seconds, without using tools. By turning a knob on each of the two overload relays, the overload trip setting can be adjusted up to plus or minus 15 per cent of nominal heater rating.

The improved coil makes possible the use of a 47 per cent lower rated transformer than with previous starters. A screwdriver is the only tool necessay for installation in any position.

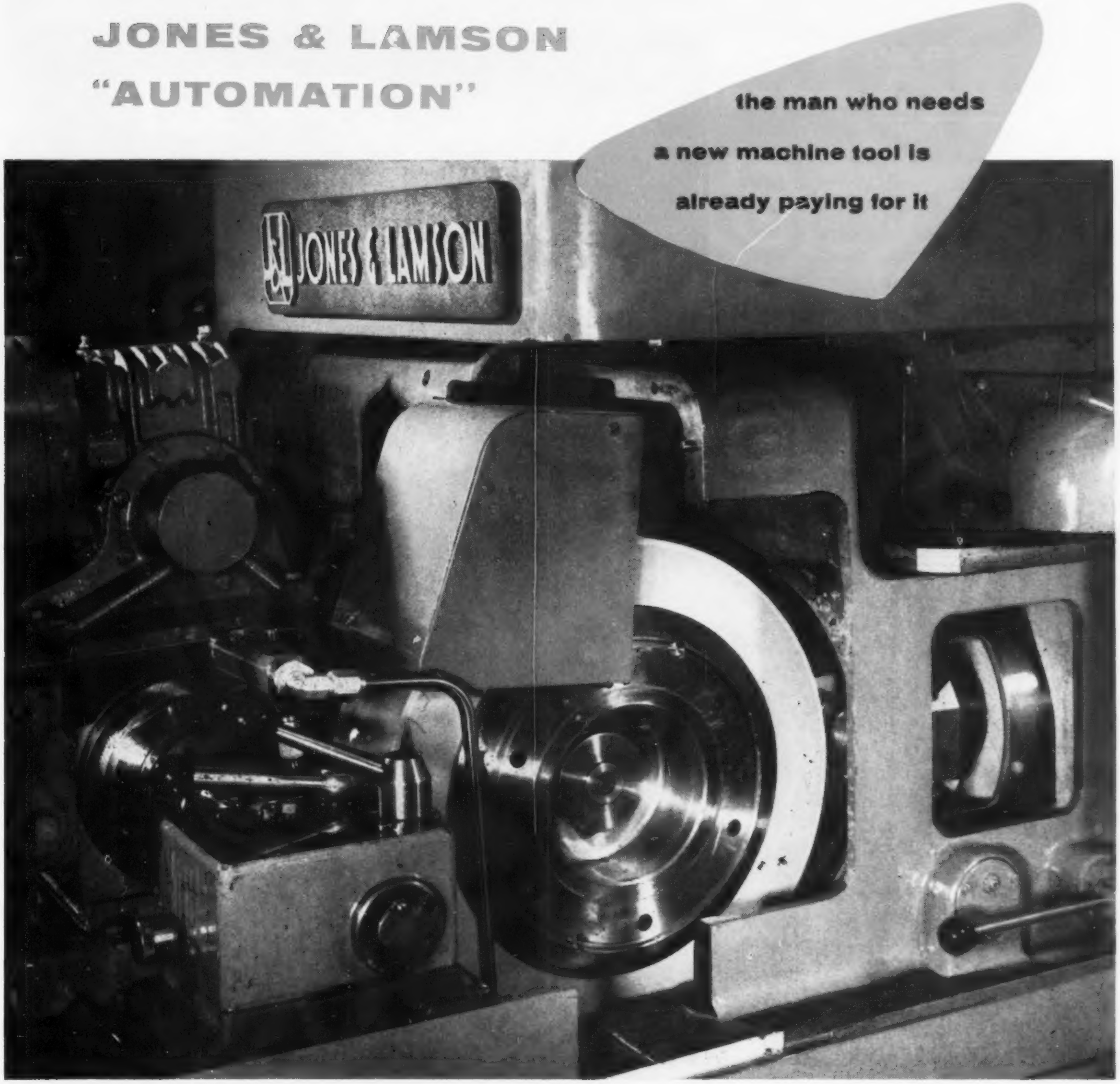
All wiring, including work on interlocks and overload relays, can be done from front of unit. Even though the starter is smaller than previous units, the new enclosure has 32 per cent more wiring space. Removable sides come off easily, providing even greater wiring space. The enclosure has a total of ten combination knockouts for wiring convenience.

Straight-through wiring speeds



Open form magnetic motor starter developed by General Purpose Control Department of General Electric Co.

JONES & LAMSON "AUTOMATION"



Now — for the first time in grinding history... no cycle time out for wheel dressing

Jones & Lamson is now introducing "PFC" (perpetual form control) grinding, an automated high production grinding method that has been termed "the greatest improvement in grinding in 50 years." It represents the first broad-scale industrial application of "CDP" (cemented diamond particles).

PFC, the result of several years of cooperative research and development by Jones & Lamson and Koebel Diamond Tool Co., Detroit, makes it possible to (1) *Completely* automate grinders. (2) Re-shape and re-size wheels faster than by any other method, and to do it continuously, with no time out for wheel dressing. (3) Control grinding wheel shape and size throughout a CDP cutter life of many months, without any attention to the cutter-dresser. (4) Provide and maintain a faster-cutting surface, free of debris. (5) Produce and maintain accurate grinding wheel shapes and forms within narrow dimensional limits.

Write for folder No. LO-5709. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Optical Comparators • Thread Tools • Thread & Form Grinders

For more information fill in page number on Inquiry Card, on page 223

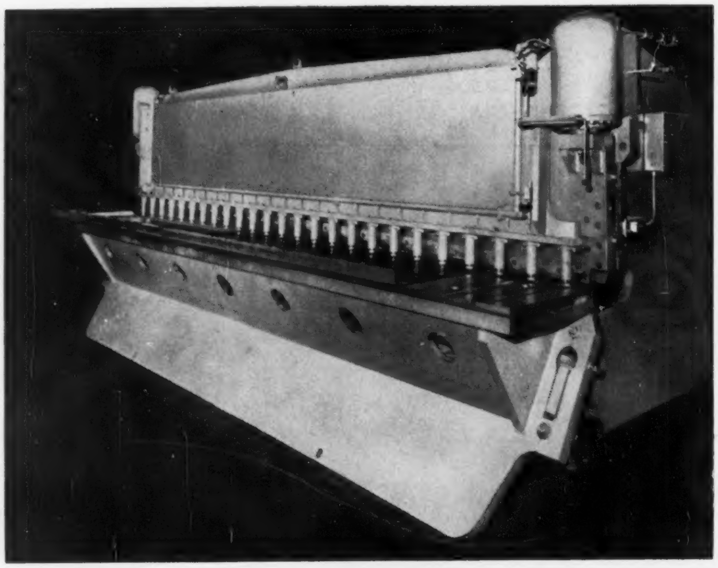
installation. Leads go directly to all line terminals at the top and from all load terminals at the bottom. The terminals take stranded or solid wire up through size 8. The start wire is Mylar insulated, reducing the possibility of a broken or shorted coil. The windings are enclosed in a thermosetting plastic that protects them against dirt, oil, or a slipping screwdriver.

The starter can be taken apart for routine inspection without using a single tool. The wrap-around cover, which is secured to the enclosure with a spring-clip latch, slides off easily. Each coil terminal is unclipped with one quick motion permitting the magnet, coil, arc chute cover, and movable contact arm to come out as one assembly.

Only a screwdriver is necessary to make all modifications. Contacts can be changed from normally open to normally closed without extra parts. A push-button or selector switch, overload relay, up to three auxiliary contacts, or a differently rated coil can be added within the same enclosure. Fuse clip kits are also available for combination forms. Three new modification kits are available for even greater flexibility than possible with the previous starter. The open form starter weighs three pounds, representing a 50 per cent saving in weight over previous forms. Weighing six pounds, the enclosed form represents a 25 per cent saving in weight over other types of enclosed forms.

Magnetic starters in the new "100 Line" series are designated CR-105, CR-106, CR-107, CR-108, CR-109, CR-110, and CR-111. Built to new NEMA ratings, the units are available in size 0 rated up to 5-hp at 440 volts and size 1 rated for 10-hp at 440 volts. They come in contactor, nonreversing, combination, reversing, and multi-speed forms.

Circle Item 118 on postcard, page 223



Hydraulic shear built by the Pacific Industrial Mfg. Co. to handle exceptionally long work

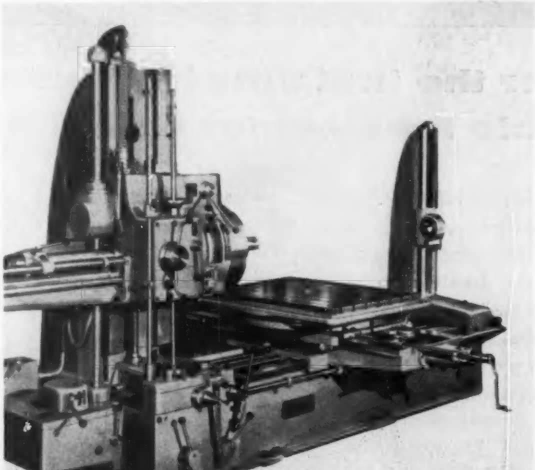
Hydraulic Shear for Long Work

The Pacific Industrial Mfg. Co., Oakland, Calif., has just built a hydraulic shear 24 feet long, which is said to be the longest machine of this kind ever constructed. It is being factory-tested prior to delivery to the Glenn L. Martin guided missile plant, Denver, Colo. This 1/4-inch shear was specially designed to handle unusually long pieces of aluminum and stainless steel.

Circle Item 119 on postcard, page 223

Imperial Boring, Drilling and Milling Machines

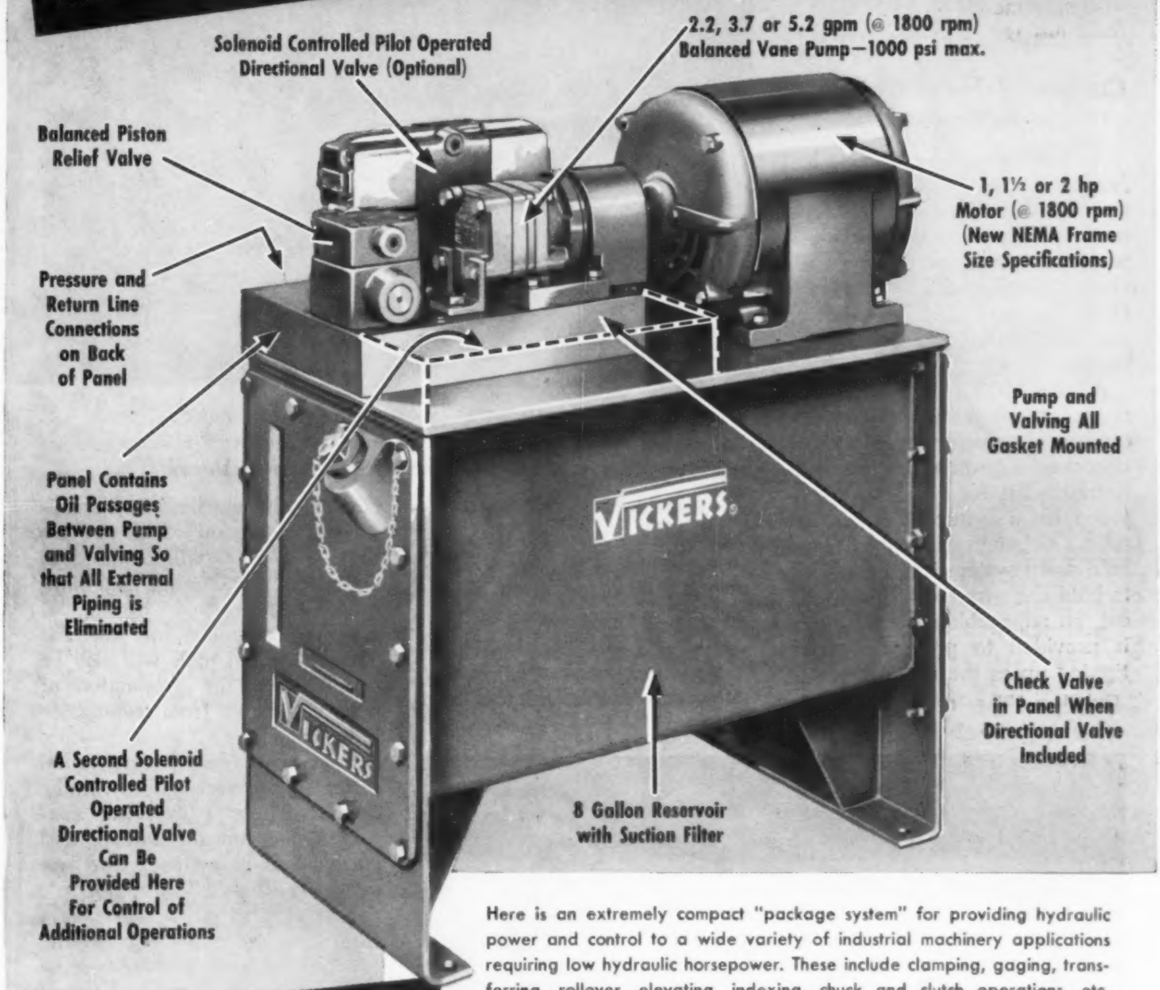
The Aaron Machinery Co., Inc., New York City, is introducing in this country a line of Imperial horizontal boring, drilling, and milling machines made in Germany. These machines have power-saving drives designed to insure full utilization of the cutting capacities of carbide-tipped tools. A wide range of speeds and feeds is provided to take care of all machining problems from the smallest to the largest working diameters of a variety of components.



Imperial boring, drilling, and milling machine

All operating elements are arranged to avoid complicated switch-gear that is susceptible to trouble. Small manufacturing tolerances are possible due to precision-scraped or ground guide ways, and settings of the highest

BETTER DESIGN . . in hydraulic power and control systems



Here is an extremely compact "package system" for providing hydraulic power and control to a wide variety of industrial machinery applications requiring low hydraulic horsepower. These include clamping, gaging, transferring, rollover, elevating, indexing, chuck and clutch operations, etc.

Note the many features indicated on the photograph above. The result is improved and simplified hydraulic design . . . also reduced installation and maintenance costs. This "package system" has great flexibility . . . is available in a wide variety of combinations of standard components assembled to suit individual requirements. Pretested and ready for immediate operation, it has also the advantage of undivided Vickers responsibility. For further information, ask for installation drawings 178706-8.

VICKERS®

Series T8 HYDRAULIC PIPELESS POWER PACKAGE*

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
Department 1403 • Detroit 32, Michigan

Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI CLEVELAND • DETROIT • GRAND RAPIDS • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N.J.) PHILADELPHIA AREA (Media) • PITTSBURGH AREA (Mt. Lebanon) PORTLAND, ORE. • ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA • WORCESTER
IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

7311-R

*These "package systems" supplement the Vickers line of standard hydraulic power units.

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

For more information fill in page number on Inquiry Card, on page 223

precision either by dial gages or optical instruments.

Models are available with a stationary toolpost, a height-adjustable drill head, and a rotary table that has crosswise and endwise movements.

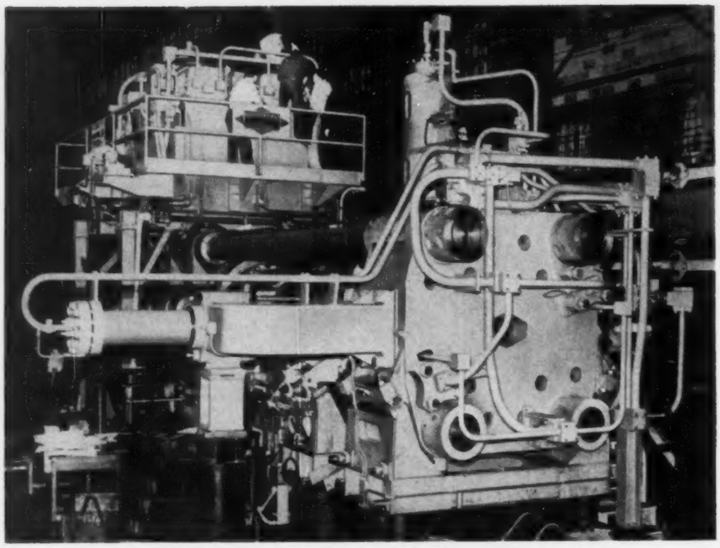
Circle Item 120 on postcard, page 223

Cincinnati Shear Designed to Cut Heavy Wire Mesh

A 2514 Series shear, 14 feet between housings, equipped for shearing wire mesh of the type used to reinforce concrete roadways has been built by the Cincinnati Shaper Co., Cincinnati, Ohio. This machine has a capacity for shearing forty-nine wires 0.394 inch in diameter.

A special feature of the machine is its unique sliding-mount arrangement, which permits manual horizontal adjustment of machine. Extra rigidity for the shear is provided by a heavy steel torque-tube. Although a conventional hold-down system is not required to hold the wire mesh during the cut, an adjustable material guide is provided to prevent it from tipping up as the cut is made.

Circle Item 121 on postcard, page 223



Birdsboro giant-size aluminum extrusion press

Giant-Size Aluminum Extrusion Press

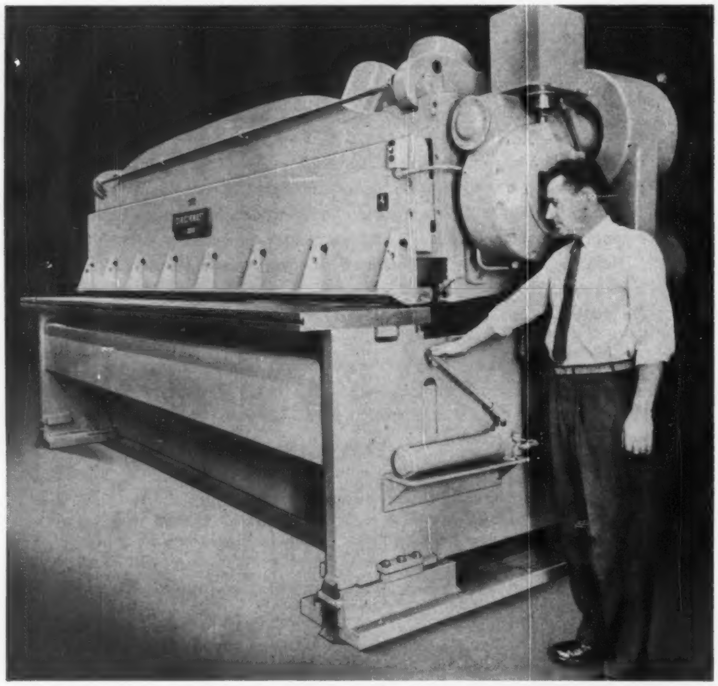
The Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa., has designed and built a 3000-ton fast-acting aluminum extrusion press for the Baltimore Division of Revere Copper & Brass, Inc., Baltimore, Md. A noteworthy feature of this huge oil-hydraulic machine is the substantial reduction of dead-cycle time. The press will be used to extrude a broad range of aluminum sections and tubing of round, rectangular, and irregular shapes. Special tools will also be supplied for the production of wide flat shapes from rectangular billets.

Four variable-delivery radial piston pumps serve the hydraulic system. These pumps are controlled electronically by fixed and variable limit switches and are driven by two 350-hp motors.

Extrusion speed, which ranges from 0 to 42 inches per minute, can be regulated from either the main pulpit or from a location overlooking the emerging extrusion. This dual control is electronically signalled and operated by an indicator hand-lever. A mandrel on the end of the main ram moves into the die to form the interior shape of the tubular product being extruded. The mandrel mover arrangement is designed to assure precision tube extrusion of high-strength aluminum alloys.

A die slide arrangement provides an alternate die location for inserting, removing, dressing, or adjusting a second die while extrusion continues uninterrupted on the first die.

Circle Item 122 on postcard, page 223



Shear built by Cincinnati Shaper Co. for heavy wire mesh

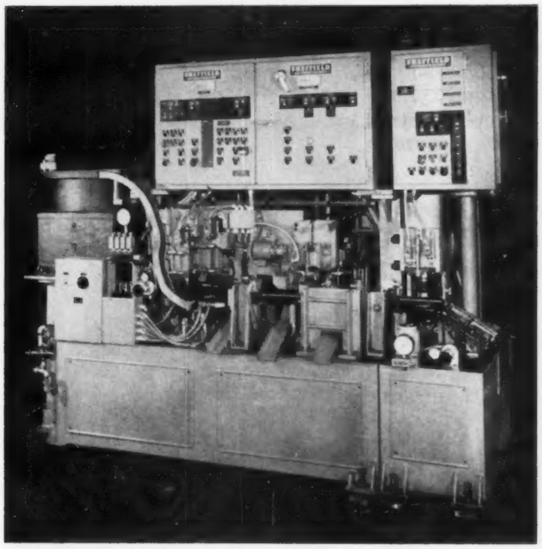


Fig. 1. Sheffield automatic assembling and gaging machine for taper roller bearings

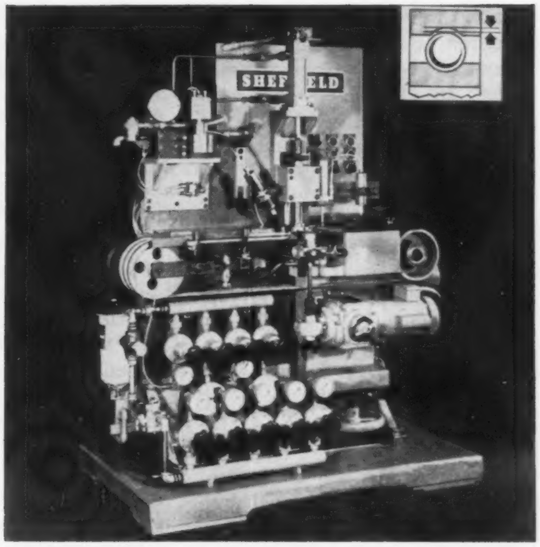


Fig. 2. Automatic radial play "Chekmatic" gage added to Sheffield line of bearing gages

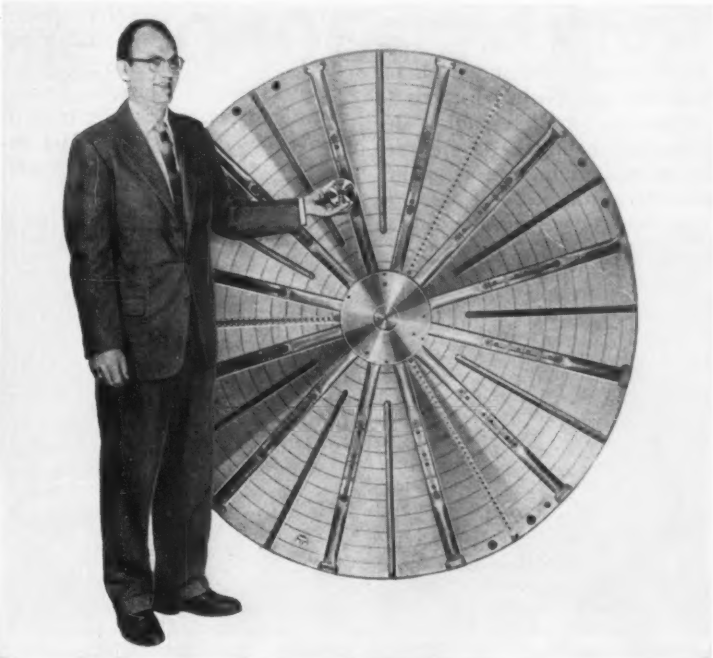
Sheffield Automatic Gaging and Assembling Machines

The Sheffield Corporation, Dayton, Ohio, is supplementing its standard line of bearing air gages with an expanding line of fully and semi-automated gaging and assembly machines designed to maintain dimensional quality control in the manufacture of all types of precision bearings.

The automatic taper roller bearing assembly machine, Fig. 1, automatically gages the diameter and flange thickness of the inner race; selects the proper number of rolls from one of six preselected size hoppers; and automatically assembles race, rollers, and cage into a bearing of predetermined tolerance. The bearing is then checked for torque, standout and noise level, and segregated as acceptable or rejected.

An automatic radial play "Chekmatic" gage that has an inspection rate of 1,200 parts per hour is shown in Fig. 2. This gage, equipped with adjustable tooling, covers a wide range of bearing sizes and automatically segregates, selects, and rejects bearings on the basis of the radial play measurement indicated by dimension line arrows in the insert in the upper righthand corner of Fig. 2.

Circle Item 123 on postcard, page 223



Giant- and midget-size Horton lathe chucks announced by the Horton Chuck Division of the Greenfield Tap & Die Corporation

Giant-Size Lathe Chuck

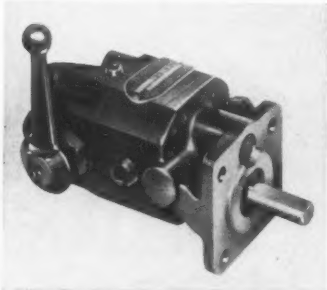
The Horton Chuck Division of the Greenfield Tap & Die Corporation, Windsor Locks, Conn., has announced the completion of the largest lathe chuck of its type ever produced. This huge J-type chuck is 66 inches in diameter and was manufactured particularly for use in machining jet-engine components requiring the utmost accuracy. Shown for comparison is a 3-inch universal chuck, the smallest of the Horton line.

The ability to center large thin-

walled rings and parts without distortion is made possible with a controlled centering pressure device. In operation, three universal jaws move in toward the work-piece. Upon contact, the jaws stop automatically. The twelve independent jaws are then moved in to pinch the part in its "as is" position. This feature incorporated in the J-type chucks permits quick, precision centering and chucking, eliminating work damage caused by excessive centering pressures.

Also featured on this chuck are spring-steel chip guards which prevent chips and dirt from entering any of the jaw way openings. The chip guards travel with the jaws keeping the ways covered at all times, regardless of jaw position. These large J-type chucks are available in sizes ranging from 21 to 66 inches in diameter.

Circle Item 124 on postcard, page 223



Pump for hydraulic systems developed by the John S. Barnes Corporation

Pump for Controlled-Flow Hydraulic Systems

The John S. Barnes Corporation, Rockford, Ill., has announced a low-cost pump designed to give performance closely matching that of a variable displacement unit. The pump is provided with a speed-control valve set to handle its maximum capacity at the wide-open position. Over a 90-degree movement output from full flow to zero can be obtained. The pump is made with a standard speed control handle and is available in four flow ranges of 0 to 1, 0 to 2, 0 to 4, and 0 to 6 gallons per minute.

This pump is adaptable to a wide range of applications, including controlled flow for traversing the table of a small grinder, for lubricating systems, and for reciprocating type cylinders in a number of applications.

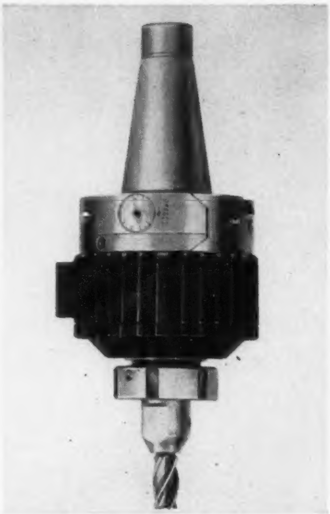
Circle Item 125 on postcard, page 223

Dimensionair Air Gages for Checking Fuel Pump Housings and Bushings

Critical center distances in gear type fuel pump housings for jet engines are compared to assure accurate assembly by means of two Dimensionair air gages built especially for this application by Federal Products Corporation, Providence, R. I. Each gage utilizes a differential air meter, designated AME-17, which directly compares center distances on one dial reading. One gage makes the comparison between bores of the housing and bronze insert bushings to determine if the flats on the bushings will have proper clearance when pressed into the housing.

The other gage compares center distance of the housing bushings with that of similar bushings for the cover plate to assure precise alignment of bearing surfaces at final assembly. This one reading comparison is a valuable timesaver, for it eliminates the need to take separate measurements for diameter and center distance to get the necessary information. Because the mating parts are predetermined to be correct, pump assembly can proceed at once.

Circle Item 126 on postcard, page 223

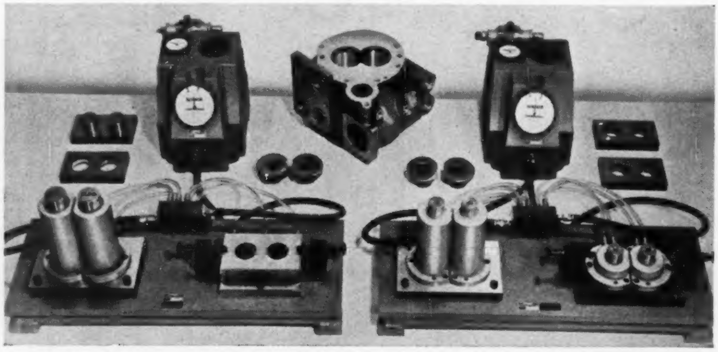


End-mill driver with orbital motion

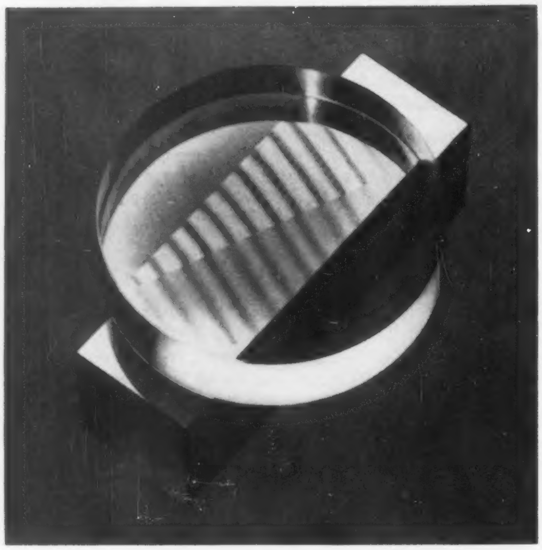
End-Mill Driver with Orbital Motion

Portage Double-Quick, Inc., Akron, Ohio, has introduced an end-mill driver which offers a new concept in end-mill cutting. This driver has provision for offset positioning, which produces an orbital motion of the cutting tool. The orbital motion permits one-pass cutting of keyways with under-size end-mills and partially eliminates the need for special diameter sizes. The orbital (or eccentric) motion also increases chip clearance, insures square slots, and permits milling true-to-center-line on keyways. The orbital motion has the same speed as the spindle.

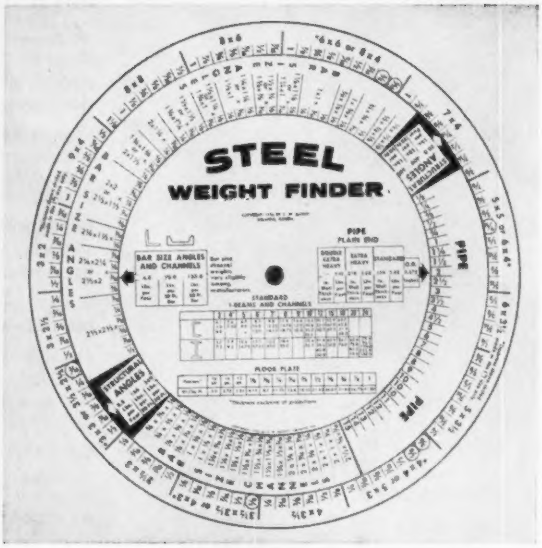
The end-mill driver also has a



Federal gage at left compares twin vertical housing bores with bronze bushings to be inserted in the bores. The gage at right compares housing bushings after insertion with cover plate bushings.



Optical flat with upper left side "Micro-Koted"



Alcott steel weight finder and slide rule

four-to-one speed ratio between the spindle and the cutter, which enables the driver to do work efficiently while the machine loafs. This increased speed ratio offers advantages to both old and new machinery. It gives old machines the advantage of increased speed, and newer machines will last longer as they can be run at lower speeds. The end-mill driver will accommodate tool shank sizes from 3/8 to 1 inch. The eccentric micrometer positioning ranges from 0 to 0.062 inch off center.

Circle Item 127 on postcard, page 223

"Micro-Koted" Optical Flats

The Van Keuren Co., Watertown, Mass., has announced a new line of precision metallic coated optical flats referred to as "Micro-Koted." These fused quartz optical flats have been coated with a hard transparent metallic material. The coating is very durable and will not peel or rub off.

The chief advantages claimed for these flats are: improved accuracy; the width of the dark fringes is less than half the width of ordinary fringes, or equivalent to about 0.000001 inch of height; the fringe boundaries are clearly defined, the familiar fuzzy borders being practically eliminated; improved contrast for greater ease in observing fringes (especially on highly reflective work); and longer life, the coated flats resisting wear much longer than uncoated flats.

The accompanying illustration demonstrates some of the advantages of the new flats. Here, an optical flat is being used to measure the flatness of an amplifying gage anvil. The upper left side of the flat has been "Micro-Koted," while the lower right-hand side is untreated. The difference in appearance of the bands can be noted. It is estimated that readability of coated flats will be five times that of uncoated flats, provided that the work surface is reasonably reflective.

Circle Item 128 on postcard, page 223

Steel Weight Finder and Slide Rule

A calculator designed to give direct reading in pounds per foot or pounds per square foot of all steel bars, pipes, and sheets is announced by the Alcott Calculator Co., Orlando, Fla. This finder has been developed to take the place of reference books and charts usually required in steel purchasing and estimating without sacrificing accuracy. It does not use the "scale" system which requires estimation.

Absolute weights are given in numbers to three and four decimal places where required. The back side of the finder, not shown, has a simple 10-inch slide rule and gives figures for hexagonal and square bars; flats and strips; and steel sheets and plates. It is made of high-quality paperboard, printed, die cut, and assembled accurately. Four movable dials give direct readings for over 1000 steel items.

Circle Item 129 on postcard, page 223

Besly Toss-Away Carbide Inserts with Lapped Finish

Toss-away carbide inserts with flat, smooth surfaces that are finished by a newly developed lapping process have just been added to the line of carbide tooling made for the metalworking industry by the Besly-Welles Corporation, South Beloit, Ill. The lapping process used in manufacturing these inserts provides a highly polished surface so that two of the inserts easily wring together. This condition is obtained by employing the most accurate methods of processing the surfaces. According to the manufacturer, this feature gives toss-away carbide inserts the desirable qualities of greater cutting tool life with less chipping and breakage.

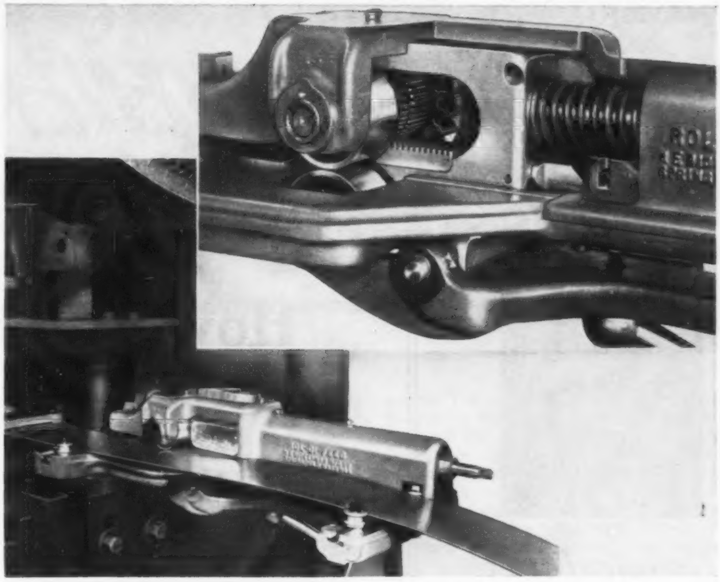
Circle Item 130 on postcard, page 223

Automatic Punch Press Feed

The H. E. Dickerman Mfg. Co., Springfield, Mass., has added a 12-inch "Rol-Di-Feed" to its line of automatic punch press feeds. This self-contained, cam-driven unit can be mounted to feed in any direction for any type of die, including piercing, blanking, compound, progressive, or drawing dies.

The feed operates smoothly and silently, feeding on the up stroke and also on the down stroke.

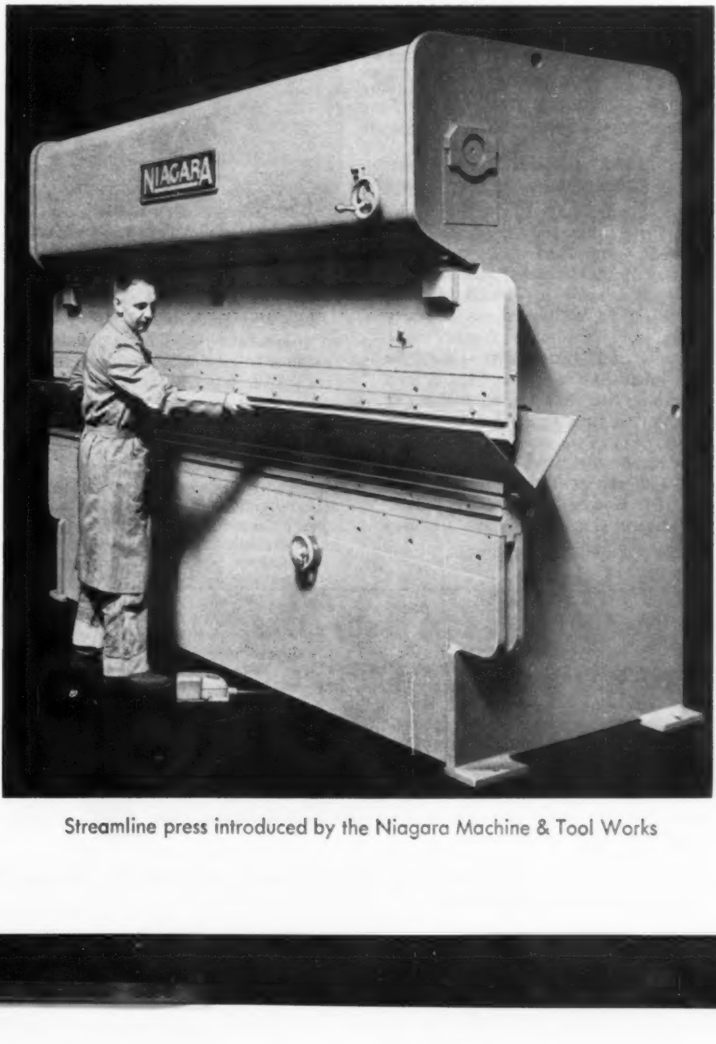
The press handles such materials as paper, plastic, fiber, or cold-rolled steel in thicknesses ranging from 0.003 to 3/16 inch. The open side design accommodates stock of almost unlimited width.



"Rol-Di-Feed" automatic stock feed for punch press

The insert view in the illustration shows the two precision gears which operate in sequence, feeding one-half of the stock on the press up stroke and the remainder on the down stroke. At the end of individual forward travel, each gear instantly locks against reverse rotation, preventing backward movement of the stock that is being fed. The "Rol-Di-Feed" unit can be mounted on the press bolster or in some cases it can be secured to the die shoe.

Circle Item 131 on postcard, page 223



Streamline press introduced by the Niagara Machine & Tool Works

Niagara Streamline Press Brake

Complete streamlining and advanced power features are combined in a newly designed line of press brakes, introduced by Niagara Machine & Tool Works, Buffalo, N. Y. The power clutch, brake, and treadle of this press have been designed for smooth action and instant response. The electropneumatic friction clutch and brake work together, permitting the ram to be inched down smoothly and softly. The portable power treadle is especially designed for the convenience of the operator.

The entire press drive is inboard, or enclosed, including motor, belts, flywheel, clutch, brake, gears, and even the connections, pitmans, and ram adjustment mechanism. Nothing protrudes to take up floor space, interfere with crane service, block lighting, or endanger safety. The one-piece frame with wrap-around crown is designed to provide maximum resistance to deflection and to maintain perma-

(Continued on page 228)

R B & W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

Factor of Safety— make it a reality

You can't calculate that with a bolt having yield strength of 4 times the working load you're automatically getting a *safety factor* of 4. Far from it. Only when the bolt is *tightened* to four times working load do you get it.

That's because rigidly fastened members can be externally loaded to the full value of residual tension in bolts without any separation or extra bolt stress.

Suppose you need a bolt for a 5000 lb. working load. For a X4 safety factor, you use a bolt of 20,000 lb. capacity, and tighten it to 20,000 lb. tension. If you tighten to only 10,000 lbs., any external load larger than this causes loosening, and progressive bolt failure from fatigue. So your safety factor is really only 2.

PRODUCTION MAN FOLLOW-THROUGH IMPORTANT

Factor of safety, then, is not established on the drawing board. It can only be put into the product by the shop man with wrench. In short, a bolt is no better than the supervision of its tightening.

A NOTE ON FLEXIBLE JOINTS

This case is different. You tighten such a joint just to working load. So use a bolt capable of this *plus* any added stress *multiplied* by your safety factor.

How to simplify bolt and nut usage

DESPITE their now unified dimensions, "standard" fasteners number thousands upon thousands of different types and sizes. More and more companies are beginning to realize that *usage* simplification offers advantages.

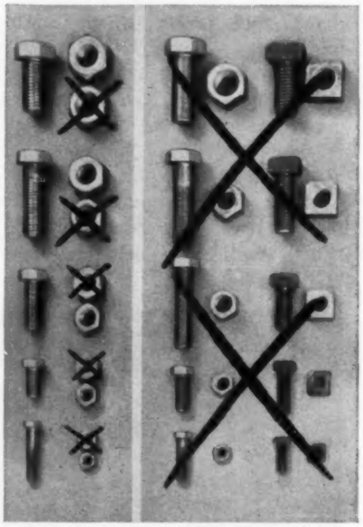
EXAMPLES

A well known electrical manufacturing company finds it no handicap to eliminate all 1/16" bolt sizes above 3/8", thereby simplifying production and purchasing.

One engineering firm eliminated 1700 different fastener items from inventory by determining that the jobs could be done as well by other sizes or types.

SOME SUGGESTIONS

To guide your thinking, RB&W points up the following ways to simplify: (1) Forget thread fits for all but specialized needs—standard "tolerance fits" have thoroughly proved themselves. (2) Why adhere to double thread standard when coarse threads prove stronger and assemble faster? (3) Stick with hex head bolts—they do better jobs than square. (4) It can save money to change diameter or length, rather than to add another item to stock. (5) Two standard physical grades meet most load range requirements—do you really need special alloys? (6) Heavy nuts really belong with larger size bolts—use finished nuts with the smaller sizes.

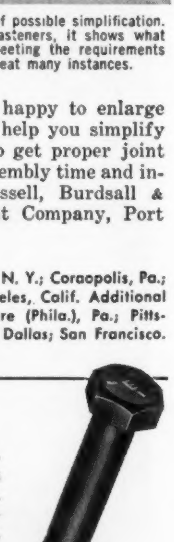


Here is a graphic display of possible simplification. From a typical array of fasteners, it shows what may be superfluous for meeting the requirements of proper fastening in a great many instances.

RB&W would be happy to enlarge on these facts, and help you simplify fastener selection to get proper joint strength and cut assembly time and inventory. Write Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, N.Y.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

High strength bolts save costly crane



At one company's plant, a large, heavy-duty crane had deteriorated due to rivets loosening. Replacing with new rivets was no permanent answer, but RB&W high tensile bolts were.

Used with hardened washers, these RB&W bolts clamp members together so tightly, no slipping into bearing takes place, holes are reinforced against fatigue, and connections become vibration-proof.

Assembling heavy duty equipment with RB&W high strength bolts in the first place can avoid such problems and create more satisfaction with the product.

For more information fill in page number on Inquiry Card, on page 223

PRODUCT INFORMATION SERVICE

Use postage-free Business Reply Cards for further information
On New Catalogues described in this issue of MACHINERY
On New Shop Equipment described in the editorial pages
On products shown in the advertisements

NEW CATALOGUES

UNIONARC WELDING—Linde Company, Division of Union Carbide Corporation, New York City. Three booklets describing the company's Unionarc welding process. They are, respectively, Bulletin F-1060 "A Better Way to Weld Steel"—giving the results of production-line tests of the Unionarc welding process. Bulletin F-1076 "New Continuous-Feed Arc Welding"—giving development and application of the Unionarc welding process in industry. Bulletin F-1066 "Unionarc Welding Process"—a technical article describing weld quality obtained from Unionarc welding process. These three booklets are available upon request from Linde Company, Division of Union Carbide Corporation, 30 E. 42nd St., New York 17, N. Y.

SOCKET SCREWS, PLUGS, AND PINS—Standard Pressed Steel Co., Jenkintown, Pa. 32-page revised basic Unbrako catalogue reviewing in detail the complete line of the company's standard socket-screw products, pressure plugs, and dowel-pins. Major product lines reviewed are heat-treated alloy-steel and stainless-steel Unbrako socket-head cap- and set-screws ranging in size from number O diameter micro-size set-screw 1/16 inch long to the giant-size cap-screws 3 inches in diameter and 12 inches long. Fasteners are all-precision, high-strength components with fully formed threads. 1

GRINDING WHEELS—Cincinnati Milling Products Division, Cincinnati Milling & Grinding Machines, Inc., Cincinnati, Ohio. Booklet entitled "Cincinnati Grinding Wheels," describing the company's PD grinding wheels and the positive duplication manufacturing process. In addition wheel markings and their meanings, grinding wheel types and uses, characteristics of incorrect wheel gradings, and grinding faults are discussed. Other sections show wheel mounting methods; design methods; how to inspect, handle, and store wheels; and many good safety practices to follow. 2

CLUTCH AND BRAKE UNIT—E. W. Bliss Co., Canton, Ohio. Bulletin 37-A, describing and illustrating the company's Type K pneumatic friction clutch and brake unit. The features of the single-disc press clutch are explained. Also described are other features of the Type K clutch and brake such as its positive engagement and disengagement, cycle welding, and ease of maintenance. A large cut-away illustration shows the inner workings of the clutch, which can be either outboard- or crankshaft-mounted. 3

PRESSURE GAGES—Helicoid Gage Division, American Chain & Cable Co., Inc., Bridgeport 2, Conn. 32-page catalogue describing the company's line of Helicoid gages, pressure instruments of utmost precision and accuracy and suitable for industrial processing and chemical applications. Engineering data describing how the gages work, types of systems, adjustments, applications, dimensional drawings, specifications, and accessories are given in addition to a listing of recommended uses. 4

PRECISION BALLS—Hartford Steel Ball Co., Hartford, Conn. Catalogue serving as a guide to quick and simple selection of precision balls for practically any requirement and material specification. Included are comprehensive data on balls of aluminum, brass and bronze, carbon steel, chrome-alloy steel, glass, hollow, K-monel, plastic (nylon-teflon, etc.) stainless steel (Types 440C and 302), as well as information on balls of special materials. 5

DISTRIBUTION TRANSFORMERS — Allis-Chalmers Mfg. Co., Milwaukee, Wis. 16-page bulletin entitled "Distribution Transformers for Rural and Industrial Substations" (75 through 500 kva, 67 kv and below, single phase), describing materials and various production steps used in manufacturing this type of transformer. A complete summary of weights and dimensions, along with outline drawings and EEI-MEMA standard accessories for the various sizes, is included. 6

HORIZONTAL BROACHING MACHINES —Colonial Broach & Machine Co., Detroit, Mich. 4-page illustrated bulletin describing the company's line of horizontal broaching machines developed for production gun rifling. Covered are design features and capacities of these machines and their application to specific gun caliber sizes. Also described are rifling tools in full length solid or wafer types. Line drawings graphically portray the construction and geometry of this line of tools. 7

CHEMICAL-RESISTANT LINING—Dow Chemical Co., Plastics Sales Department, Midland, Mich. Illustrated booklet entitled "Saraloy 898, Chemical Resistant Sheet," giving detailed information on this flexible thermoplastic chemical-resistant lining for storage tanks, processing tanks, medium- to large-diameter pipes and fittings, fume ducts, and hoods. Information includes data concerning its properties, the materials, equipment, and procedure for installation, care and repair of linings, and storage of the sheet. 8

FIRST CLASS
Permit No. 53
(Sec. 34.9, P.L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

MACHINERY
93 WORTH STREET
NEW YORK 13, N. Y.

READERS' SERVICE DEPT.

NICROBRAZ DATA — Wall Colmonoy Corporation, Detroit, Mich. Engineering Data Sheet 16, covering specifications for the full range of Nicrobraz high-temperature brazing alloys. Eleven alloys in the Nicrobraz family are illustrated. For each is given nominal composition, solidus temperature, liquidus temperature, brazed joint ductility, recommended brazing temperature, and recommended atmosphere. Important recommended applications are highlighted for each alloy. **9**

WELDING EQUIPMENT—Air Reduction Sales Co., a Division of Air Reduction Co., New York City. Catalogue 2300 entitled "Heliweld Equipment," describing the advantages of the Heliweld process and the factors which determine equipment selection. Information is given on various types of manual, semi-automatic, and automatic equipment and on accessory devices such as the arc starter, high-frequency oscillator, control panel, and filler-wire feeder. **10**

SELF-LOCKING LIGHTWEIGHT NUTS—Aircraft Products Division, Standard Pressed Steel Co., Jenkintown, Pa. Illustrated folder describing the company's self-locking nuts that are 49 per cent lighter than their standard counterparts. Good wrenching efficiency is retained since total height of nut is usable wrenching surface. Added strength is provided by six reinforcing ribs spaced around the hexagon nut. **11**

WIRE CLOTH—Cambridge Cloth Co., Cambridge, Md. 94-page ring-bound catalogue illustrating the company's complete line of industrial wire cloth, screens, and wire cloth products. A complete description of the types and sizes of industrial wire cloth available, typical applications, and a number of useful metallurgical tables are included. **12**

CENTRIFUGAL PUMPS—Goulds Pumps, Inc., Seneca Falls, N. Y. Bulletin 725.2, describing the company's glassed centrifugal pump for handling corrosive liquids in the chemical process and allied industries. All parts of this pump coming in contact with corrosive materials are glassed and resistant to all acids except hydrofluoric at 212 degrees F. and alkalies up to pH of 12 at 212 degrees F. **13**

PUSHER TYPE CONTINUOUS FURNACES—Ipsen Industries, Inc., Rockford, Ill. Technical bulletin P-57, describing standard controlled-atmosphere, multi-zone pusher furnaces for carburizing, carbo-nitriding, and general heat-treating applications up to 1850 degrees F. Cross-section drawing and a specification table listing over-all dimensions, hearth dimensions, tray dimensions, maximum load per tray, and maximum heat input are included. **14**

TITANIUM DATA—Mallory-Sharon Titanium Corporation, Niles, Ohio. 24-page booklet entitled "Fact File," designed as a handy reference guide for design, materials, and production engineers. The booklet gives key data on titanium's advantages; physical, mechanical and corrosion properties; metallurgy; as well as production information on machining, forming, and welding. **15**

FAST-MACHINING STEELS SELECTION GUIDE—Joseph T. Ryerson & Son, Inc. catalogue describing over twenty different types of carbon, alloy, and stainless steel, each designed for maximum output of machined parts. Also featured are the new fast-machining leaded steels. Both free-cutting bar and plate steels are included. **16**

RATCHET WRENCHES—Lowell Wrench Co., Worcester, Mass. Catalogue 61, giving complete information and order specifications on the company's reversible ratchet gear and socket wrenches. Full specifications are given for industrial wrenches, Warnock strap wrenches and Swaco railroad car movers, and hopper car wrenches. **17**

FILTRATION EQUIPMENT—Industrial Filter & Pump Mfg. Co., Chicago, Ill. Bulletin EP-100, entitled "Modern Filtration for the Plating Industry," featuring filtration equipment and methods. Tubular, vertical, and horizontal filters are covered in detail showing typical applications, flow diagrams, and cross-section drawings. **18**

CHUCKING REAMER SELECTOR CHART—DoALL Co., Des Plaines, Ill. Wall chart listing individual standard reamer sizes ranging from 0.0400 to 0.5010 inch in straight flute, right- and left-hand spirals; also twenty-seven sets in fractional, decimal, wire gage, letter, taper pin, and helical diemakers' sizes. **19**

AUTO-POSITIONER—Dixon Automatic Tool, Inc., Rockford, Ill. Illustrated bulletin describing several new standardized units that may be combined with existing equipment to automate small parts assembly operations. Featured is the air-operated Dixon auto-positioner, which places piece-parts from 1/16 inch to 3 inches at speeds up to 6000 per hour **20**

CHROMEL-D—Hoskins Mfg. Co., Detroit, Mich. Catalogue covering Chromel-D, a 35-20 nickel-chromium-iron heating element alloy recommended for use in controlled-atmosphere furnaces operating at temperatures up to 1800 degrees F. Complete prices and specifications on this alloy as supplied in wire, ribbon, and furnace strip form are included. **21**

HEAVY-DUTY RELAYS—Arrow-Hart & Hegeman Electric Co., Hartford, Conn. 8-page catalogue giving complete information on the company's line of Type IMP (interchangeable multiple pole) and FMP (fixed multiple pole) heavy-duty relays. Diagrams and dimensional drawings are used to illustrate the versatility of these relays. **22**

CAPS AND PLUGS—Shurclose Seal Co., Detroit, Mich. 4-page catalogue describing the company's caps and plugs. Complete specifications are given for both rubber and plastic closures for the protection, sealing, or masking of threaded parts, pipe ends, or tubing. Seven styles of stock sizes are covered. **23**

DIAMOND COMPOUNDS—Amplex Corporation, West Hartford, Conn. Bulletin describing and pricing the company's diamond compounds. Listed are grades from 1/2- to 170-micron range in a variety of concentrations; also WC diamond compound for finishing tungsten carbide, heavy concentration only. **24**

SPECIAL TOOLS—Sutton Tool Co., Sturgis, Mich. Bulletin No. 70, describing and illustrating the company's special tools and work-holding devices. Featured are standard and special chuck jaws, expanding mandrels, gear-hobbing arbors, special collets, milling-machine adapters, cut-off blades, and many other unusually designed tools. **25**

INDUSTRIAL TACHOMETERS—General Electric Co., Schenectady, N. Y. Bulletin

Product Information Service

Use postage-free Business Reply Card below for further information on New Catalogues or New Shop Equipment described in this issue and products mentioned in the advertisements.

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

1	2	3	4	5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24	25	26	27	28
29	30	31	32	33	34	35	36	37	38	39	40	41	42
43	44	45	46	47	48	49	50	51	52	53	54	55	56

NEW SHOP EQUIPMENT

101	102	103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142
143	144	145	146	147	148								

ADVERTISED PRODUCTS

Page . . . . Advertiser . . . .
Page . . . . Advertiser . . . .
Page . . . . Advertiser . . . .
Page . . . . Advertiser . . . .

Please print your name and address

NAME . . . .
TITLE . . . .
COMPANY . . . .
CO. ADDRESS . . . .
CITY . . . . ZONE . . . . . . STATE . . . . . .

This card is void after November 1, 1957 M-8/57

GEC-1258A, describing a variety of generators and indicating or recording instruments available for measuring speed of any industrial rotating equipment, including alternating- and direct-current tachometers and hand tachometers. . . 26

COUNTING CIRCUITS—Taylor-Winfield Corporation, Warren, Ohio. Bulletin SP-19, describing the company's precise welding controls using Dekatron tubes in counting circuits that control welding time. These controls improve the consistency of welding time longer than 15 cycles. Block and schematic diagrams illustrate the purpose and operational principles of these controls. 27

AUTOMATIC VALVES—A. W. Cash Valve Mfg. Corporation, Decatur, Ill. 12-page catalogue featuring the company's complete line of automatic valves. Main uses, installation tips, and construction features along with specification tables for each principal series of Cash Acme valves are covered. Cut-away illustrations show how each type of valve is designed. 28

INDUSTRIAL WELDERS—General Electric Co., Schenectady, N. Y. Bulletin GEC-1259C, including product features, specifications, power requirements, operating data, and list of operational features for the company's alternating-current welders in 300-, 400-, and 500-ampere ratings. 29

HARDNESS CONVERSION CHART—Torsion Balance Co., Clifton, N. J. Desk-size chart containing conversion data for Rockwell tests and other hardness scales. In addition to the hardness conversion, this chart also has tables for cylindrical corrections. 30

BLIND RIVETS—Huck Mfg. Co., Detroit, Mich. Catalogue describing the company's line of PT (pull through) and 9SP (self-plugging) blind rivets. Advantages of both types of blind rivets are illustrated, and a number of typical applications with easy-to-read cross-sectional drawings are included. 31

FLOOR TURNTABLES—Aronson Machine Co., Arcade, N. Y. Bulletin FT 57, describing the company's floor turntable welder positioners ranging in capacities from 1000 to 120,000 pounds. 32

CARBIDE-TIPPED TOOLS—Saw Division, R. Hoe & Co., Inc., New York City. 24-page booklet entitled "Carbide Tipped Saws and Tools," showing how carbide cutting edges can solve many of industries materials cutting problems. Typical materials include wood, fiber, plastics, and non-ferrous metals. 33

PRESS BRAKES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 90, describing and illustrating the company's 30- and 50-ton press brakes Series 1B. Fully described and illustrated are the company's electropneumatic friction clutch, power brake, and power treadle. 34

HYDRAULIC WHEEL PRESSES—Watson-Stillman Press Division, Farrel-Birmingham Co., Inc., Roselle, N. J. Bulletin 530-B, describing the company's standard hydraulic wheel presses which range in capacities from 100 to 800 tons. Included are specifications and dimensions on all standard size presses. 35

WELDERS—Lincoln Electric Co., Cleveland, Ohio. Folder describing the company's Idealarc 300-, 400-, and 500-ampere combination alternating- and direct-current welders. Specifications and construction details are included. . . . 36

POWER UNITS—Hi-Shear Rivet Tool Co., Torrance, Calif. 4-page brochure describing the company's electric-hydraulic and air-hydraulic power units. Included are descriptions of features, photographs, and flow charts for both of these units. 37

PIPE AND TUBING—Trent Tube Co., a subsidiary of Crucible Steel Company of America, East Troy, Wis. 48-page catalogue describing Trent Tube stainless-steel and high-alloy pipe and tubing products ranging in size from 1/8 inch to 40 inches outside diameter. 38

OIL-AIR RATIO REGULATOR—Hauck Mfg. Co., New York City. Catalogue 722-A, describing the company's PRO oil-air ratio regulator—a unit designed to accurately and consistently deliver the proper oil pressure which will correspond to the air pressure passing through burners. 39

DIAMOND TOOLS—Precision Diamond Tool Co., Elgin, Ill. Catalogue 4-57, featuring the company's precision economy diamond tools. The tools illustrated are throw-away type dressers. They will not require any resetting. 40

FIRST CLASS
Permit No. 53
(Sec. 34.9, P.L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

POSTAGE WILL BE PAID BY—

MACHINERY

93 WORTH STREET

NEW YORK 13, N. Y.

READERS' SERVICE DEPT.

USE THIS ▲ CARD FOR INQUIRIES

USE THIS ▼ CARD FOR SUBSCRIPTIONS

(See other side)

FIRST CLASS
Permit No. 53
(Sec. 34.9, P.L. & R.)
New York, N. Y.

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in the United States

MACHINERY

93 WORTH STREET

NEW YORK 13, N. Y.

SUBSCRIPTION DEPT.

EXPANDERS—Grotnes Machine Works, Inc., Chicago, Ill. Bulletin entitled "Expanders—Mechanically and Hydraulically Powered," giving construction details and specifications. **41**

SERVO SYSTEM ANALYZER—Servo Corporation of America, New Hyde Park, N. Y. Illustrated folder describing five models of the company's Servoscope analyzer, including the new Model F. . . .**42**

HEAVY-DUTY FOOT-SWITCHES—Linemaster Switch Corporation, Woodstock, Conn. Folder describing the company's forty models of Hercules heavy-duty foot-switches. **43**

BENDING MACHINES—Struthers Wells Corporation, Machinery Division, Titusville, Pa. Bulletin 5512, describing the company's tangent (light series) bending machines. **44**

FILES—Heller Tool Co., subsidiary of Simonds Saw & Steel Co., Newcomerstown, Ohio. 16-page catalogue describing the company's complete line of White Tang files. **45**

GRINDERS—Gardner Machine Co., Beloit, Wis. Illustrated catalogue describing the company's large and small grinding machines. Production data and basic specifications are included. **46**

MOTOR STARTERS AND CONTACTORS—Allis-Chalmers Mfg. Co., Milwaukee, Wis. 12-page bulletin describing the company's line of motor starters and contactors in sizes 4, 5, and 6 (Type 425), 50 to 400 hp. **47**

SCREWS—Reed & Prince Mfg. Co., Worcester, Mass. Ring-bound catalogue listing the company's complete line of screws, nuts, and bolts. Detailed specifications and prices are included. **48**

FLOW METERS—Brooks Rotameter Co., Lansdale, Pa. Bulletin describing the company's line of rotameter type instruments designed for flow measurement and control. **49**

VARIABLE TRANSFORMER — Superior Electric Co., Bristol, Conn. Bulletin SE-L3578, giving illustrations, outline drawings, and technical rating data on the company's Powerstat Type LW136 variable transformer. **50**

LAMINATED DISC FILTERS—Wm. W. Nugent & Co., Inc., Skokie, Ill. 16-page bulletin describing and illustrating the company's laminated fiber disc filters. **51**

GRINDING WHEELS—Simonds Worden White Co., Dayton, Ohio. Catalogue and stock list describing the company's entire line of grinding wheels. **52**

CENTRIFUGAL PUMPS—Ingersoll-Rand, New York City. 16-page bulletin featuring the company's Class GT general-purpose centrifugal pumps. **53**

EYELETS—Waterbury Companies, Inc., Waterbury, Conn. Catalogue describing the company's eyelets, ferrules, and terminals for which tools are available. . .**54**

FILTERS, REGULATORS, AND LUBRICATORS—Watts Regulator Co., Lawrence, Mass. Folder F-15B, describing the company's pneumatic products. **55**

MILLING CUTTERS—Newcomer Products, Inc., Latrobe, Pa. Bulletin describing the company's RC milling cutters with "Throway" carbide inserts. **56**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

CATALOGUES

1 2 3 4 5 6 7 8 9 10 11 12 13 14
15 16 17 18 19 20 21 22 23 24 25 26 27 28
29 30 31 32 33 34 35 36 37 38 39 40 41 42
43 44 45 46 47 48 49 50 51 52 53 54 55 56

NEW SHOP EQUIPMENT

101 102 103 104 105 106 107 108 109 110 111 112 113 114
115 116 117 118 119 120 121 122 123 124 125 126 127 128
129 130 131 132 133 134 135 136 137 138 139 140 141 142
143 144 145 146 147 148

ADVERTISED PRODUCTS

Page . . . . Advertiser . . . .
Page . . . . Advertiser . . . .
Page . . . . Advertiser . . . .
Page . . . . Advertiser . . . .

Please print your name and address

NAME . . . .
TITLE . . . .
COMPANY . . . .
CO. ADDRESS . . . .
CITY . . . . ZONE . . . . . STATE . . . . . .

This card is void after November 1, 1957 M-8/57

Are You Reading Your Own Copy of MACHINERY?

TO: MACHINERY, 93 Worth Street, New York 13, N. Y.

Please enter my subscription for the period indicated below, and send me my free copy of MACHINERY's DATA BINDER.

☐ **ONE YEAR @ $4.00** ☐ **TWO YEARS @ $7.00** ☐ **THREE YEARS @ $8.00**

(Deduct 5% from these prices if you send payment with your order)

Name . . . .
Address . . . .
City . . . . Zone . . . . State . . . .

WE WOULD APPRECIATE THE INFORMATION BELOW FOR STATISTICAL CIRCULATION AUDITS

Position . . . . Firm . . . .
Firm Address . . . .
City . . . . Zone . . . . State . . . .
Chief product manufactured at this plant: . . . .
Approximate number of employes (check one):

UNDER 50 51-100 101-500 501-1000 OVER 1000

M8/57

By having your own copy you can clip and file articles, Reference Sections, and Data Sheets for your own use . . . take plenty of time to read the important material in each issue.

USE THIS HANDY ORDER FORM

Just fill in and mail this postcard today, and we'll start your subscription at once. ***IN ADDITION, WE SHALL SEND YOU — FREE — A LOOSE-LEAF BINDER CONTAINING 148 PAGES OF DATA SHEETS . . . A BINDER THAT GROWS IN USEFULNESS EACH MONTH AS YOU ADD NEW MATERIAL.***

Send in the card today.

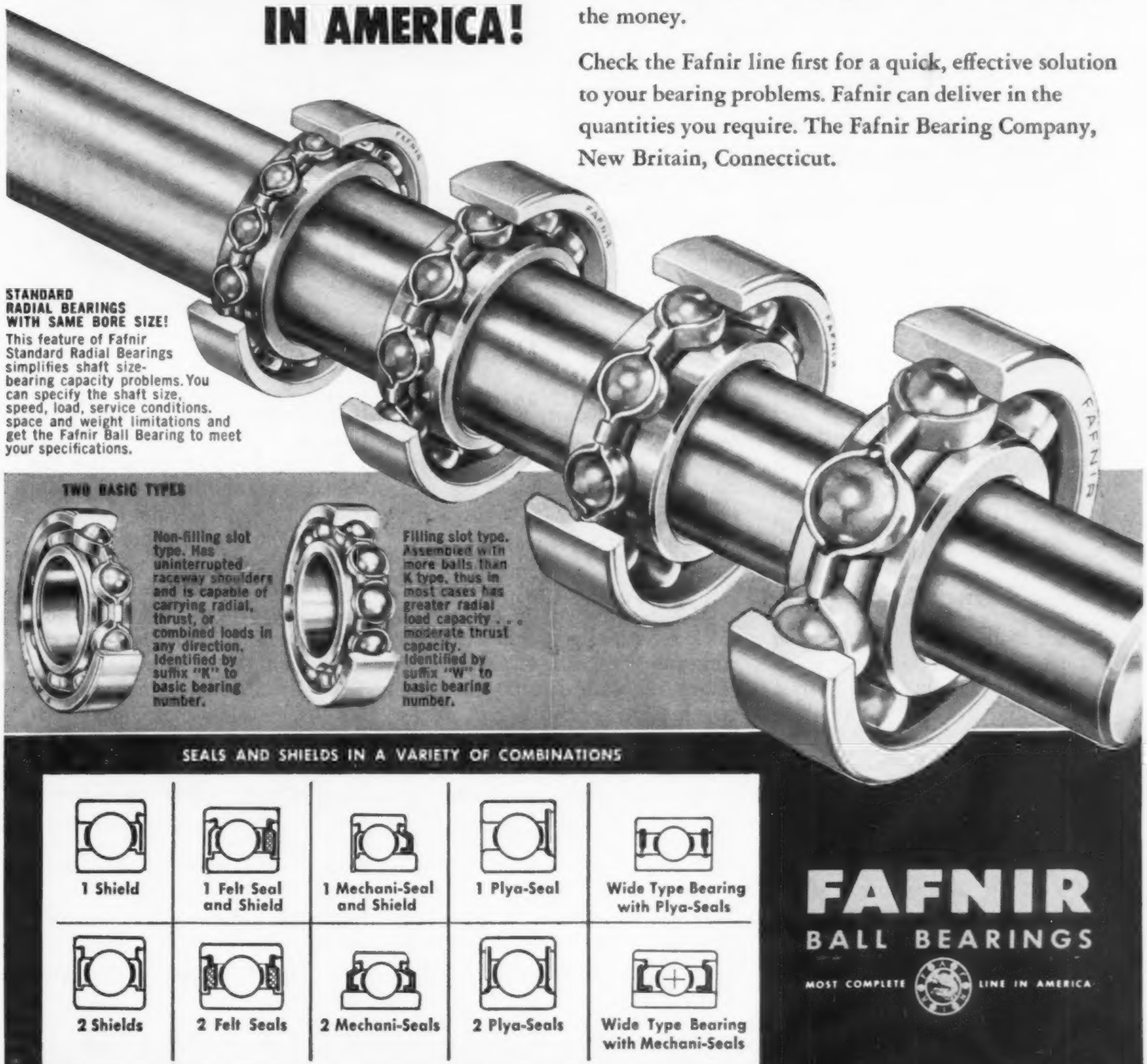
We'll bill you later.

For the most effective answers to your bearing problems...

FAFNIR OFFERS THE MOST COMPLETE LINE OF BALL BEARINGS IN AMERICA!

Whatever your bearing needs, your best bet is Fafnir. The reason . . . Fafnir makes America's most complete line of ball bearings, ranging from standard radial to custom-made jet engine types. Various tolerances and combinations of seals and shields enable Fafnir to supply the best bearing for the purpose — the *most* bearing for the money.

Check the Fafnir line first for a quick, effective solution to your bearing problems. Fafnir can deliver in the quantities you require. The Fafnir Bearing Company, New Britain, Connecticut.



STANDARD RADIAL BEARINGS WITH SAME BORE SIZE!
This feature of Fafnir Standard Radial Bearings simplifies shaft size-bearing capacity problems. You can specify the shaft size, speed, load, service conditions. space and weight limitations and get the Fafnir Ball Bearing to meet your specifications.

TWO BASIC TYPES

Non-filling slot type. Has uninterrupted raceway shoulders and is capable of carrying radial, thrust, or combined loads in any direction. Identified by suffix "K" to basic bearing number.

Filling slot type. Assembled with more balls than K type, thus in most cases has greater radial load capacity . . . moderate thrust capacity. Identified by suffix "W" to basic bearing number.

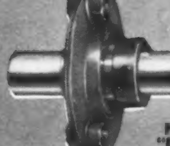
SEALS AND SHIELDS IN A VARIETY OF COMBINATIONS

FAFNIR
BALL BEARINGS
MOST COMPLETE LINE IN AMERICA

A COMPLETE LINE OF HOUSED UNITS including:

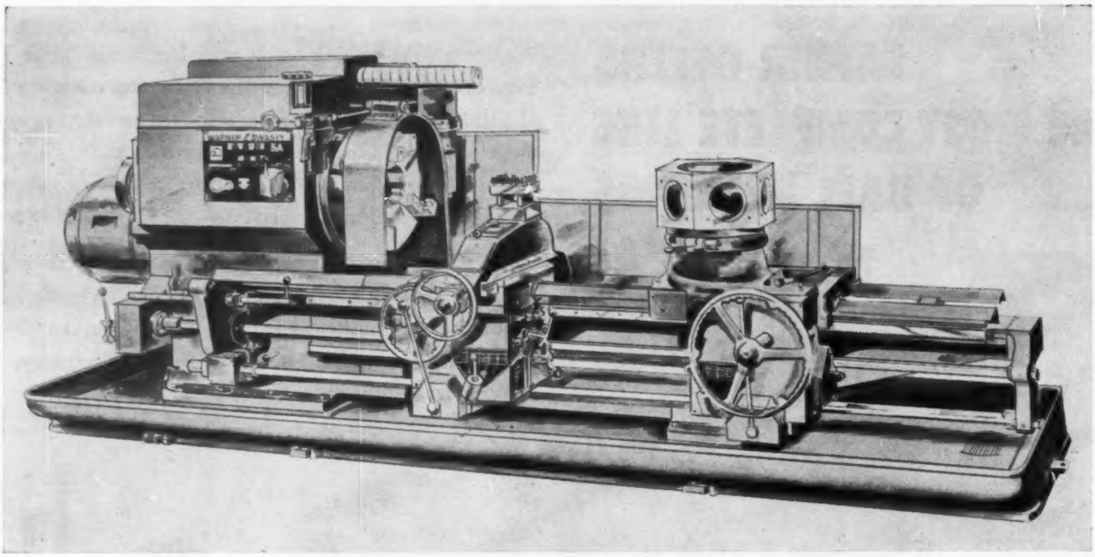
CAST IRON PILLOW BLOCKS
LAK Illustrated

CAST IRON FLANGE CARTRIDGES
LCJ Illustrated



PRESSED STEEL "Economy" UNITS
Flangette Illustrated

For more information fill in page number on Inquiry Card, on page 223



Saddle type turret lathe announced by Warner & Swasey Co.

nent alignment of bearings and rams. A 50 per cent deeper throat is made possible by the incorporation of heavier, deeper uprights without an increase in floor space.

The press is available in 30- and 50-ton models, with over-all bed lengths of 6 to 12 feet. It will perform a wide range of forming, bending, punching, blanking, and related operations.

Circle Item 132 on postcard, page 223

Warner & Swasey Saddle Type Turret Lathe

A 36-inch swing 5-A machine has been added to the line of extra heavy-duty saddle type turret lathes built by the Warner & Swasey Co., Cleveland, Ohio. This lathe is designed to provide the balanced power, accuracy, and maneuverability necessary for precision, high-production metal-turning on large work-pieces. It has a 75 hp, 2-speed main drive motor coupled to the spindle through an automatic, hydraulic-shift pre-selector headstock. With this drive motor and headstock combination, the new machine offers twenty-eight unduplicated turning speeds, from 10 to 280 rpm, making it adaptable to a majority of existing tooling, including the very latest in special turret lathe attachments. A choice of sixteen easily selected reversible power feeds is provided in each apron. These feeds are reversible in the cross-slide apron and applicable to either cross or longitudinal feeding.

Operation of the automatic, hydraulic-shift pre-selector headstock is virtually effortless, eliminating the fatiguing strain usually associated with speed changing on a machine of this size. A single lever controls engagement of the forward and reverse clutches, neutral and brake positions, and initiation of the gear shift or speed change—all accomplished merely by pushing the lever "in" toward the headstock. The shift is completed automatically in a matter of seconds without further attention by the operator, leaving him free to concentrate on tool positioning.

A large hand-knob controls the selection of, and indicates, spindle speeds. Speed selection can be made while the machine is cutting, thus saving time, and at each setting the operator can read the rpm and surface speed for a complete range of work diameters directly from the pre-selector dial. The only other headstock controls are the high-low motor push-buttons, power chuck wrench control, and spindle inching button used for effortless positioning of heavy chucks and fixtures for greatest loading ease. All of the headstock controls are confined in a small area, close to the spindle nose, for maximum functional utilization by the operator.

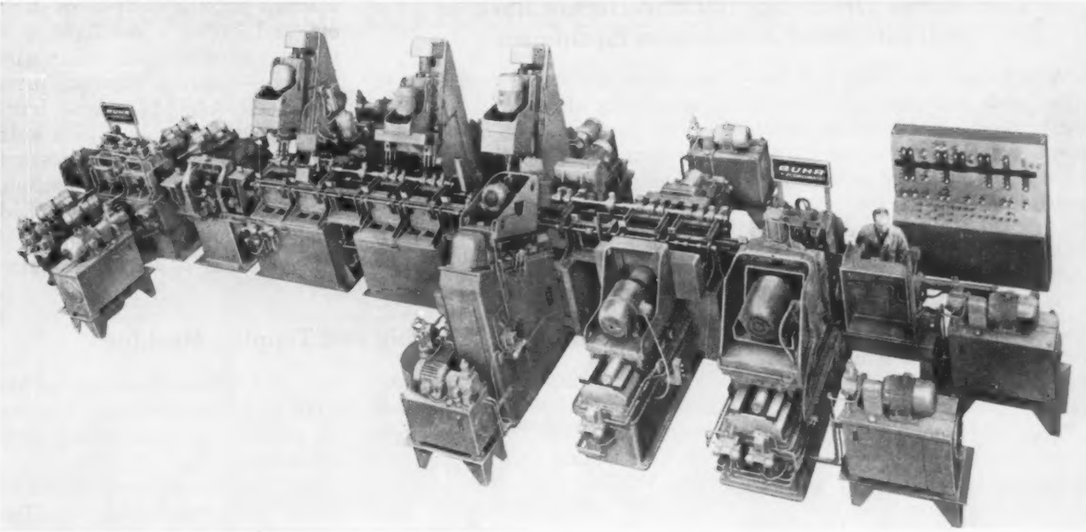
Circle Item 133 on postcard, page 223

Buhr Economatic for Processing Exhaust Manifolds

A twenty-station Economatic built by the Buhr Machine Tool Co., Ann Arbor, Mich., completely machines both right- and left-hand exhaust manifolds. A noteworthy feature of the machine is the facility with which it can be changed over from right- to left-hand parts, or vice versa.

This machine completes the processing of a part every twenty-six seconds, or 144 pieces per hour, operating at 100 per cent efficiency. The processing includes forty-one operations: fifteen drilling; eight spot-facing; five milling; five countersinking; four tapping; two reaming; one counterboring; and one probing.

Other features include: load stations designed to replace a casting qualifying gage; automatic probe and blow-out before tapping; special sectional-base con-



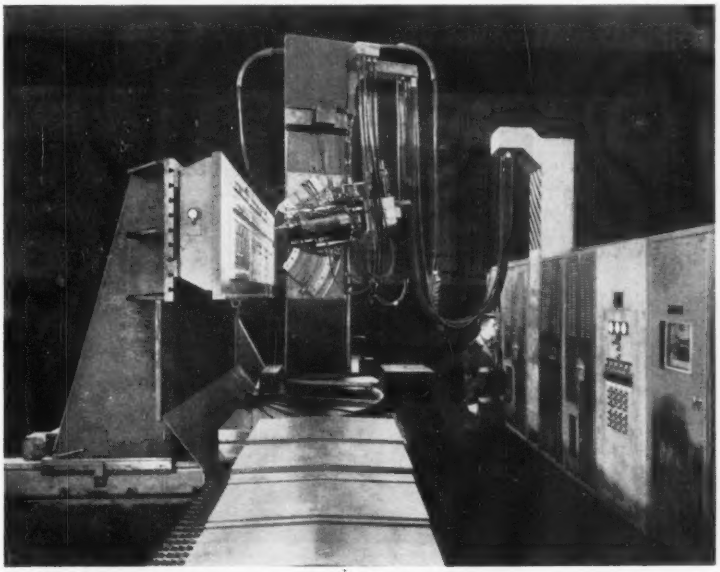
Economatic brought out by Buhr Machine Tool Co. for processing exhaust manifolds

struction to facilitate future part changes; standard and special interchangeable parts; spindles arranged for pre-setting of cutting tools; hardened and ground steel ways; central mist lubrication on all heads; individual push-button stations on all units; emergency stop above all stations; JIC standards throughout; automatic lubrication fault-detector; and automatic lubrication of all moving parts.

Circle Item 134 on postcard, page 223

Magnetic Tape Runs Airframe Profile-Milling Machine

Shipment of what is claimed to be the first variable-axis airframe profile-milling machine operated solely by magnetic tape commands was made to Lockheed Aircraft Corporation, Burbank, Calif., for producing F-104 Starfighters. Built by Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., the machine, called Variax, incorporates the G & L Numericord system of magnetic tape control. Decimal numerical data, programmed directly from part drawings, is converted electronically into time-motion command signals. Variax can mill intricate designs rapidly in ferrous or nonferrous material, either billet stock or forgings.



G & L tape-operated airframe profile-milling machine

Movements are derived from a combination of horizontal movement of the column on its runway and vertical movement of the saddle on its column ways for 360 degrees of path control in plane of the angle plate on which the work is mounted. In addition, the illustrated five-axis machine provides depth movement of the head along the spindle axis, head swiveling in the plane of the saddle, and column swiveling on the cutter center line.

Once the machine is oriented, it automatically is positioned to the correct point of cutter entry, then feeds and retracts. Eliminated, or radically reduced in the time they take, are such nonproductive operations as template setting and changing, tool setting, and progressive gaging. Time and material losses from wasted operator motion, lack of skill, or miscalculation are also practically eliminated.

Circle Item 135 on postcard, page 223

Burr-Master Deburring and Chamfering Machine with Integrated Automation Equipment

A universal, two-station deburring and chamfering machine with integrated automation equipment for high production rates is announced by the Modern Industrial Engineering Co., Detroit, Mich. This machine, designated Model BMED-14S, chamfers and deburrs gear teeth at each end of a groove. Each part is automatically processed through two work positions in a cycle time of six seconds at a rate of 600 parts an hour.

The machine removes sharp edges on the ends of the gear teeth and simultaneously gets rid of burrs resulting from the gear-cutting process. Although the automation equipment is custom-tailored, the basic universal machine will handle spur gears, helical, and straight-sided as well as involute form splines with pitch diameters ranging from 5/8 inch to 6 1/2 inches.

The automation equipment, also designed by the manufacturer, is operated by only one air cylinder and four interlocked limit switches. For easy tool access, the automation equipment is mounted on two guide bars—loosening two screws is all that is necessary to move it out of the way.

The parts are fed from a distribution system to the "in" slide and chuted to a "foolproofer" stop where they are checked by mechanical fingers for proper horizontal position. If misaligned, the machine automatically shuts itself off (and flashes a red light as a visual signal) until manually cleared. Properly oriented parts continue through the chute, butting against a spring-loaded gate for retainment prior to entering the machining cycle. The machine is driven by a 1-hp motor and weighs about 2200 pounds.

Circle Item 136 on postcard, page 223

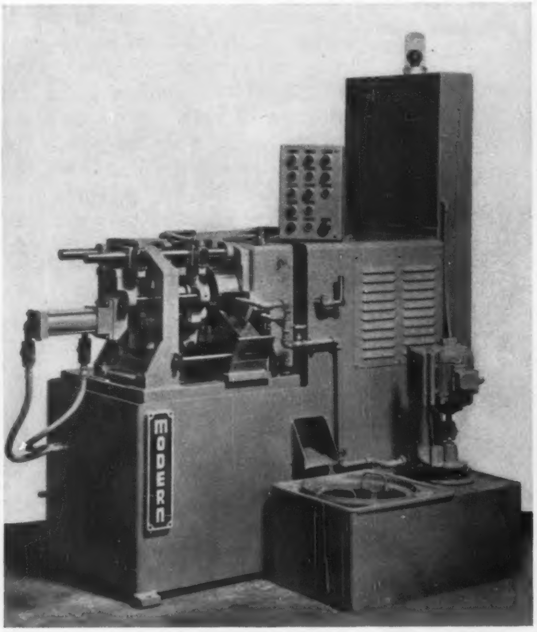
Automatic Drilling and Tapping Machine

A Model 408 Beco automatic drilling and tapping machine has been brought out by the Batchelder Engineering Co., Inc., Springfield, Vt. This machine is built for high-production drilling or tapping of long rivets, electrical terminals, or other headed parts. It supplements the earlier Model 410 short rivet drilling and tapping machine and is equipped with a long shank hopper feeder. The machine will accommodate shank lengths from 3/8 inch to 3 3/4 inches and shank diameters from 0.090 to 0.375 inch. Provision is made for accurate positioning and secure clamping of the work to assure straight, concentric axial holes in parts such as thin-wall tubular rivets. Concentricity of hole and outside diameters within 0.002-inch true indicator reading is possible without using drill bushings.

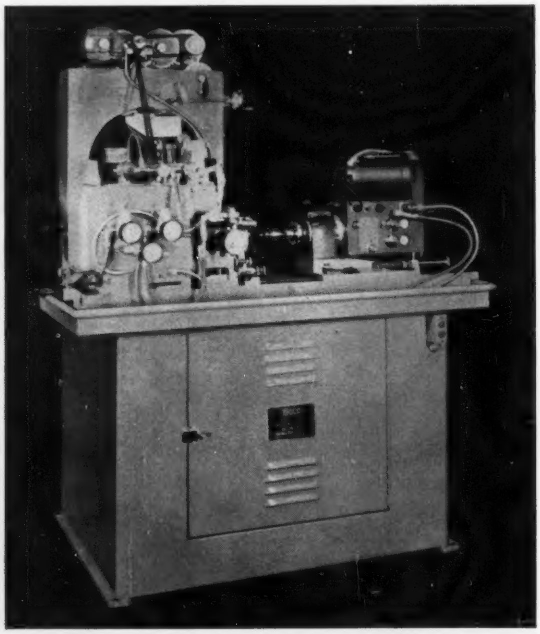
Automatic self-reversing attachments are used for tapping. Removable coolant tanks are provided for changing coolant from drilling to tapping, thereby eliminating the necessity for cleaning out the machine base.

The machine is operated by compressed air, controlled by an electric solenoid valve. At an air line pressure of 65 to 100 psi, the machine operates at approximately 400 strokes per cubic foot of free air. The tool and hopper feeder are driven by individual three-phase motors.

Circle Item 137 on postcard, page 223

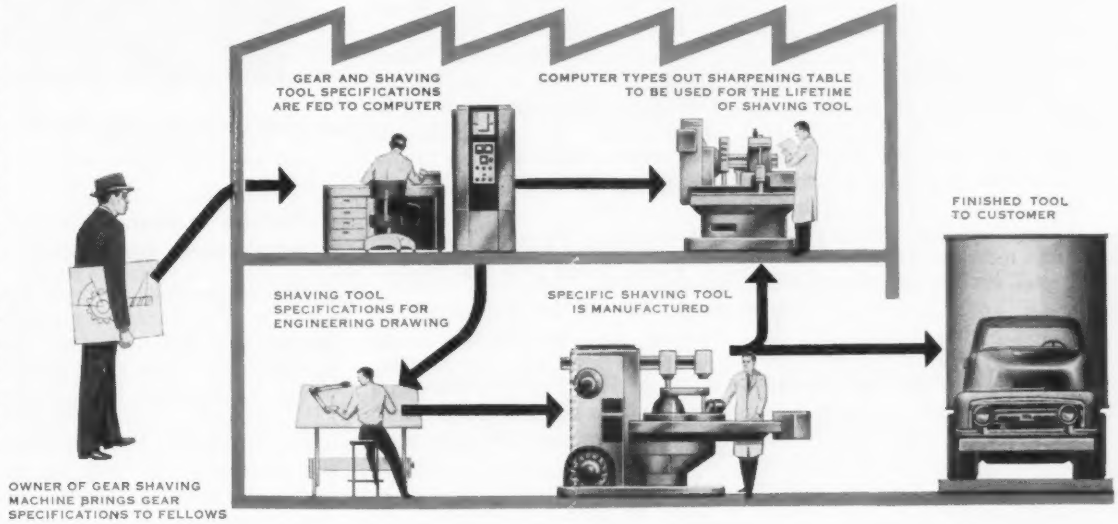


Automated Burr-Master deburring and chamfering machine made by Modern Industrial Engineering Co.



Automatic drilling and tapping machine brought out by the Batchelder Engineering Co., Inc.

Fellows Gear Shaper Co. designs tools 22 times faster with a Bendix Computer



problem:

For many years, Fellows Gear Shaper Company designed gear shaving tools and cutters for its customers by the same method—extensive layouts combined with manual calculations. A faster and less expensive method was needed.

solution:

In 1955, Fellows turned this problem over to its new Bendix G-15 Digital Computer. Now, gear and shaving tool specifications for each order are typed into the computer. In a matter of minutes all information needed for manufacturing drawings is computed and typed out. The G-15 also generates a sharpening table good for the life of the tool. Pricing tables are prepared automatically and all designs are indexed and recorded on magnetic tape to prevent duplication of engineering work on future orders. Time saving on tool design alone averages 2200%.

Many companies engaged in manufacturing have found ways to lower costs and provide better service by putting the Bendix G-15 to work. A report on how Fellows is cutting costs while cutting gears is available. It contains many valuable ideas. Mail the coupon for your copy.

Bendix Computer

OFFICES IN WASHINGTON, D.C., DALLAS, LOS ANGELES AND CHICAGO

Export Representatives
Computing Devices of Canada, P. O. Box 508, Ottawa 4, Ontario
Bendix International Division, 205 E. 42nd Street, New York 17, N.Y.

BENDIX COMPUTER DIVISION—BENDIX AVIATION CORPORATION
5630 ARBOR VITAE STREET, LOS ANGELES 45, CALIFORNIA

☐ *Please contact me for an appointment to discuss applications of the G-15.* ☐ *Send literature and a copy of the report.*

NAME____________________
TITLE____________________
COMPANY____________________
ADDRESS____________________

For more information fill in page number on Inquiry Card, on page 223

Automatic Gun-Drilling Machines

Automatic gun-drilling machines developed by the Morris Machine Tool Co., Cincinnati, Ohio, are made in one- and two-way models which provide infinitely variable spindle speeds and feeds, adjustable automatic load control, and a completely co-ordinated high-pressure coolant and chip-removal system.

The machines are equipped with either 6- or 9-inch stroke Morris Air-Oil-Matic drill units, especially designed for drilling deep holes 1/8 inch in diameter and up. They are also suitable for drilling shallow holes where straightness, size, and finish are crucial; and for jobs where speed necessitates a high rate of metal removal, while finish is not critical. Many sizes of gun drills with variations in length can be used.

Spindle speeds up to 8000 rpm are obtained with a simple adjustment. Feeds up to 40 inches per minute are possible with infinitely adjustable feed strokes. Speeds and feeds are completely independent of each other. The entire drilling unit is adjustable on a sliding base available for 6- or 9-inch movement.

The adjustable load control automatically detects dull drills, chipped drills, hard spots in the material, or insufficient coolant, and instantaneously reverses the quill, thereby saving the drill.

Coolant pressures up to 1000 psi are made possible by a completely coordinated system consisting of a rear spindle coolant inductor, high-pressure pump, gage, and filters. The coolant is shut off automatically on the return stroke, and can be switched off (together with the spindle motor) to permit accessibility for setup. The chip disposal trough is located behind the bushing.

The fixture shown is for drilling cylindrical parts. It has V-block holding devices which may be interchanged to accommodate twenty-one different size pieces.

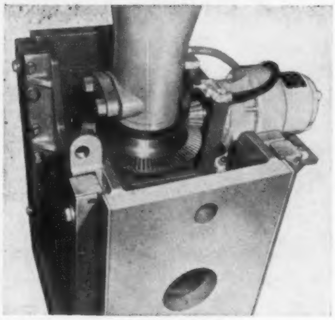
Circle Item 138 on postcard, page 223

Trimming Presses Remove Flash from Die Castings

A line of low-cost trimming presses has been introduced by Clearing Machine Corporation, Chicago, Ill. These presses are designed for use in removing flash from die castings and have wide bed areas with low tonnage and convenient bed openings for disposal of scrap. Hydraulically or mechanically operated models are available.

The standardized bed and slide areas of these machines range from 32 by 18 inches to 36 by 24 inches, and 18 by 12 inches up to 34 by 20 inches, respectively; lengths of stroke from 3 to 12 inches; strokes per minute from 30 to 120. Capacities range from 25 to 60 tons. Standard slide adjustments and slide knockouts are available.

Circle Item 139 on postcard, page 223

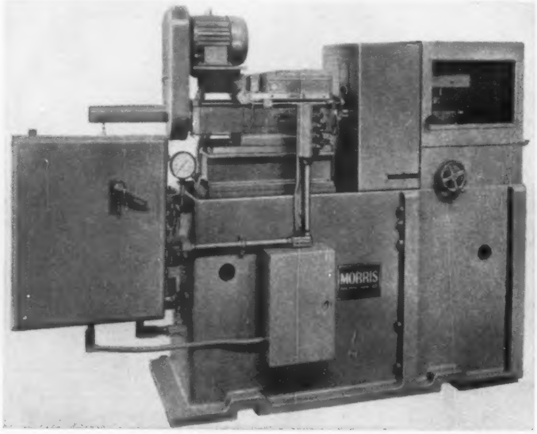


Verson motorized adjusting unit for press rams

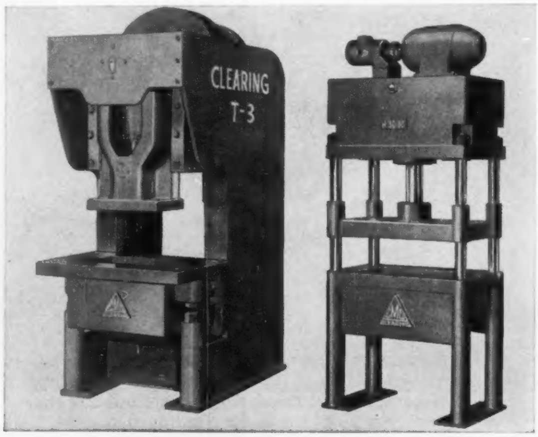
Verson Motorized Ram Adjustment for Presses

The Verson Allsteel Press Co., Chicago, Ill., is offering push-button-controlled motorized ram adjustment as optional equipment on all Verson open-back, inclinable presses. This adjusting feature is useful in handling short-run press work that requires frequent changing of tooling. One press provided with multiple die sets and the ram adjustment feature can take care of the forming requirements of a group of components.

A 1/2- to 1-hp electric motor, depending on size of press, is mounted directly on the press ram. Up and down lock type control buttons at the operator's station actuate the ram-adjusting motor. A pinion gear mounted on the motor shaft revolves the adjusting screw through the bevel gear, machined as part of the



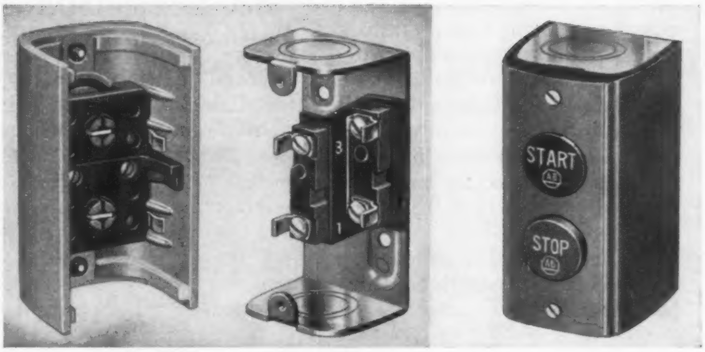
Morris automatic gun-drilling machine



Clearing press designed to remove flash

screw. The adjusting screw is threaded in the pitman and connected to the ram which can be moved up or down depending on the direction the screw is traversed by the motor. A clamping cap on the pitman secures the adjustment screw at the desired position. Thus the press ram can be quickly adjusted when changing from one die set to another.

Circle Item 140 on postcard, page 223



Standard-duty push-buttons and starter switches brought out by the Allen-Bradley Co.

Allen-Bradley Push-Buttons and Selector Switches

A line of Bulletin 800 standard-duty push-buttons and selector switches with a molded wrap-around cover which contains and protects the contact mechanism has been announced by the Allen-Bradley Co., Milwaukee, Wis. Removing the cover exposes the wiring terminals in the base, so that wiring can be done in a minimum of time. A molded Bakelite shield completely covers and protects the contact mechanism when the cover is removed—careless wiring cannot interfere with contact operation when unit is assembled.

Concentric knockouts are provided in both the top and bottom of the heavy metal base for convenient wiring. The push-buttons can be easily rotated 90 degrees for mounting the station in a horizontal position. The push-button stations are available in NEMA 1 enclosures with one, two, and three buttons, or two buttons and a pilot light.

The selector switches can easily be changed from a two-position to a three-position switch, or vice versa, in a matter of seconds. A strip of seven nameplates is furnished with each switch to meet any designation required.

Circle Item 141 on postcard, page 223

High-Speed, High-Power Lathe Built for Carbide Tooling

A 50-inch Niles engine lathe developed for high-speed, high-power machining with modern carbide tooling has been introduced by the Hamilton Division, Baldwin - Lima - Hamilton Corporation, Hamilton, Ohio. This lathe is capable of accommodating a drive motor up to 100 hp and can be furnished as a standard turning lathe or as a combination boring and turning machine. Other optional features include either mechanical or electronic feeds, with or without thread cutting.

The lathe has a 50-inch diameter faceplate, and a swing of 38 inches over the carriage bridge and 52 inches over the carriage wings and bed. Special features include full apron pendant control; live center tailstock (Fig. 2) with anti-friction spindle and compensating adjustment for between-center loads and linear expansion; tool relief and taper attachment on both carriages; totally enclosed feed-box; and hydraulically assisted gear shifting.

The headstock, Fig. 1, has a high and low range of speed gears. Standard feed and thread range can be obtained without gear changing at the headstock end. It is furnished with a lubricating pump and can be equipped for

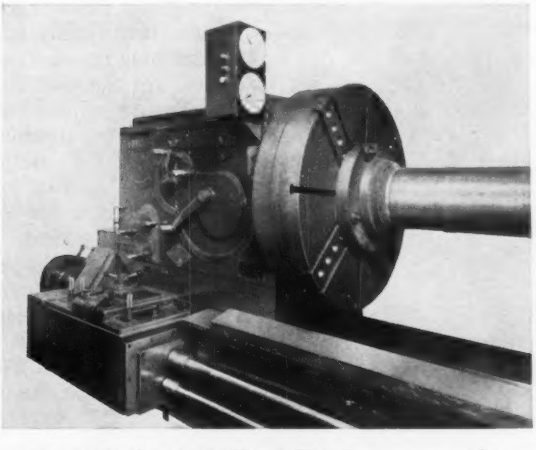


Fig. 1. Headstock of Niles A-50 lathe announced by Baldwin-Lima-Hamilton Corporation

Fig. 2. Live center tailstock with anti-friction bearings used with headstock shown in Fig. 1

tailstock power traverse and power movement to the tailstock quill. Spindle speed ranges from 1.5 to 35.1 rpm through faceplate drive and 40.2 to 182 rpm through spindle drive. The range of feeds is from 0.0025 to 0.625 inch per faceplate revolution for longitudinal feed, and 0.0012 to 0.312 inch for cross-feed.

The end-gearing is arranged so that special feeds or threads can be obtained by using special gears. The headstock also is set up for cutting coarse leads. The feed drive is taken from a faster running shaft to avoid excessive speed-up from the spindle to the feed-box which provides thirty-two feeds or threads. The lead-screw is used only for thread cutting. A separate spindle shaft provides the feeds.

Lathe carriages are equipped with power traverse and lubrication pumps and incorporate wear plates. The taper attachment of each carriage has a maximum capacity of 4 inches per foot on the diameter and 48 inches maximum travel in one setting. A thread-chasing indicator is located at the right end of each carriage.

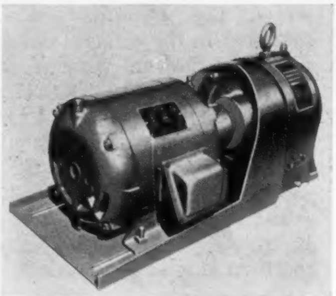
Circle Item 142 on postcard, page 223

Howell "Line-O-Drive" Gearmotor Speed Reducer

Howell Electric Motors Co., Howell, Mich., has added a "Line-O-Drive" gearmotor to its line of speed reducers. To remove this motor from an installation, only four bolts are loosened to free it from the end shelf and to disconnect the flexible coupling. The mounting slots in the end shelf are standardized to conform with NEMA dimensions.

Motor capacities in the "Line-O-Drive" line offer a complete range from 1 to 75 hp. Each of these reducer type drives has an output speed range of from 350 to 7 1/2 rpm. Double and triple reduction units are available in foot and flange mountings.

Another important feature of the new drive is its flexibility.



"Line-O-Drive" gearmotor speed reducer

Speed reducer ratios up to 1478 to 1 can be easily changed with standardized drive components. The "Line-O-Drive" incorporates a flexible coupling that absorbs misalignment and end float through the rocking action of the hubs in the sleeve.

Circle Item 143 on postcard, page 223

Snyder Segmented Transfer Machine for Processing Automotive Intake Manifolds

A 175-foot long segmented transfer machine line that machines automotive engine intake manifolds from rough casting to finished part has been designed and built by the Snyder Tool & Engineering Co., Detroit, Mich. Either two- or four-barrel carburetor manifolds can be fed into the line at random. Built-in sensing devices automatically shift heads at three stations to provide the required machining operations. No idle stations are needed in processing the two parts.

One of 76-foot long Snyder parallel milling sections of manifold processing line

The new line, which produces parts at a net rate of 136 manifolds per hour, consists actually of three individual transfer machines that have a total length of 230 feet. To put the processing line in the required 175-foot long factory space, two twenty-nine-station, 72-foot long transfer milling machines like the one illustrated were located parallel (side by side). These two machines feed their combined output through automation devices to a third thirty-two-station, 86-foot long transfer drilling machine.

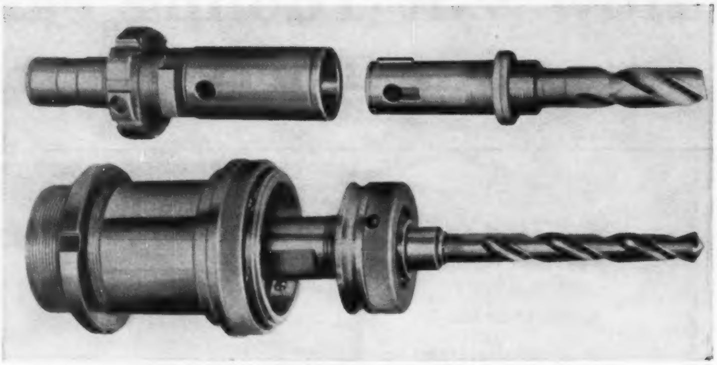
The huge processing line removes about 18 pounds of metal from each 70-pound intake manifold and makes 2450 pounds of chips per hour. More than 5400 pounds of parts are in continuous process in the machining line.

Circle Item 144 on postcard, page 223

(This section continued on page 236)

For more information fill in page number on Inquiry Card, on page 223

Quick-Change Pre-Set Tools for Automatic Screw Machines



(Upper view) Scully-Jones, quick-change chuck that permits back removal of tool. (Lower view) chuck designed for front removal of tool.

A line of quick-change chucks designed to hold pre-set end-cutting tools on multiple-spindle automatic screw machines is announced by Scully-Jones & Co., Chicago, Ill. The new tooling is designed to reduce down time with quick-change tools; to facilitate the use of pre-set tooling that guarantees accurate reproduction of parts and eliminates in-the-machine adjustments; and to permit operation of the machine at the optimum cutting speed that gives lowest machining cost.

The line includes both front-removal and rear-removal chucks designed to accommodate the broadest possible range of tools and installation requirements. They permit a considerable latitude in tool size that can be used on any particular bar or chucking machine and make it possible to replace worn tools in seconds.

Resharpened tools are pre-set in an adapter while the machine is in operation. When a tool change is required, the one in the machine is quickly replaced by a pre-set sharp tool.

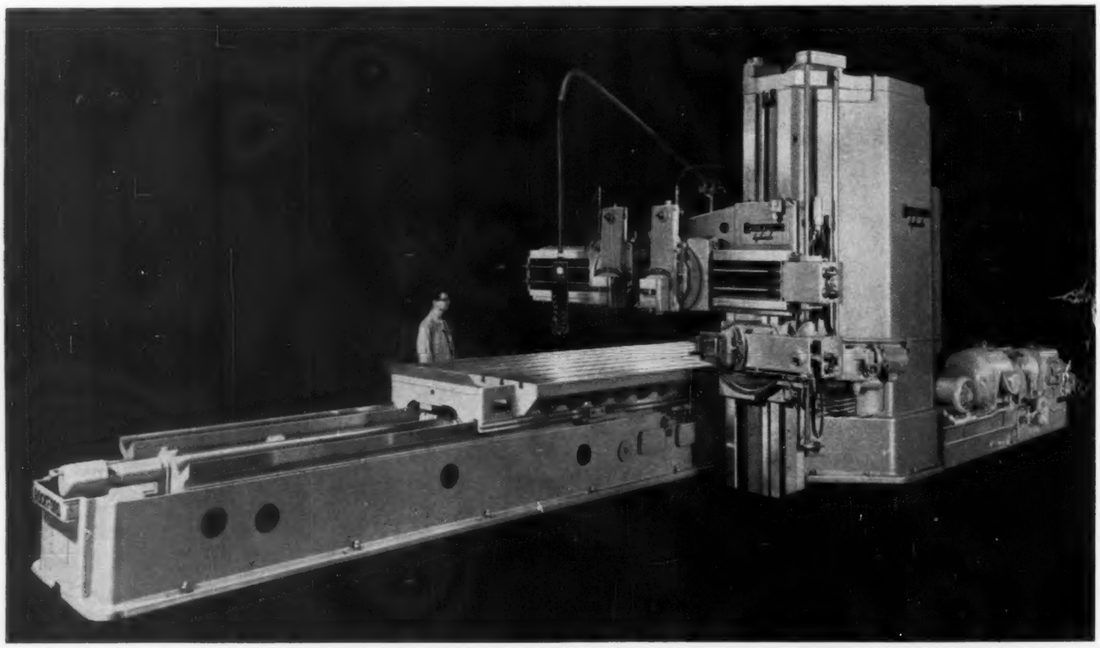
Circle Item 145 on postcard, page 223

Heavy-Duty Hydraulic Planer

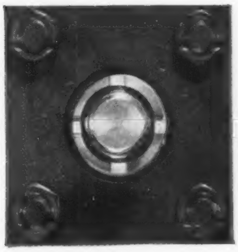
A heavy-duty "Hy-Draulic" planer designed specifically to take full advantage of the most modern cutting tools and cutting techniques is being manufactured by the Rockford Machine Tool Co., Rockford, Ill. This machine has power rapid traverse, power rail elevation, automatic power rail-lock, and automatic way lubrication. An adjustable side-head rail assures accurate alignment of the side-head with the rail heads. The heavy box-section table is carried on wide-angle vee ways.

This planer is available in the larger sizes—60 by 60 inches and above—and may be had with either the conventional single circuit, or the new high-speed h3 triple circuit.

On both of these new machines all movements of the heads are controlled from the pendant. On machines with the h3 drive, complete table control, including speed adjustment with a direct



De luxe heavy-duty hydraulic planer manufactured by the Rockford Machine Tool Co.



Here are the world's finest power cylinders

...competitively priced!

This ad is written for the man who has thought all cylinders are "pretty much alike." That just isn't so, and your Hannifin man would like an opportunity to show you why...

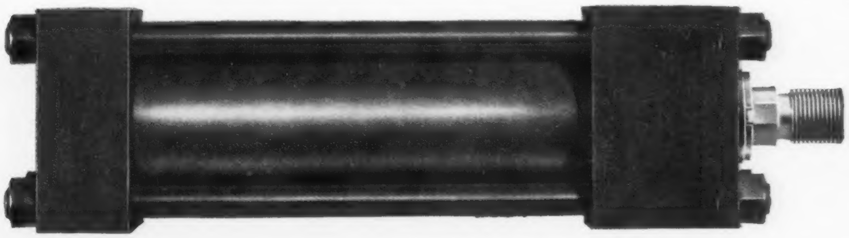
He'll show you design features that other cylinders simply do not have... extra quality workmanship at critical points that pays off in longer life ...accessibility that simplifies their infrequent maintenance. And when he talks price and delivery, you will find these better features cost you no more, can often be delivered sooner.

We think you'll agree that it pays to standardize on Hannifin cylinders.

AIR AND HYDRAULIC

HANNIFIN

POWER CYLINDERS



COMPLETE CYLINDER FILE

Write for your copy of this new Hannifin Cylinder File . . . complete, easy-to-use, easy-to-order-from information on five lines of Hannifin Cylinders. Write Hannifin Corporation, 509 S. Wolf Road, Des Plaines, Ill.

For more information fill in page number on Inquiry Card, on page 223

reading speed indicator, is also obtained from the pendant.

Engagement and actuation of all head feed and traverse movements are also possible from the pendant. Push-button-operated electrical clutches in the feed-box control the actuation of all feed movements. The counterbalanced swiveling pendant enables the operator to run the machine from any position.

The planer has a new "Tooltrol" feature, which is an integral part of the head control and permits manual inching in both vertical and horizontal directions of either head from either end of the rail, or the head controls. This, coupled with the pendant actuation of feed and traverse movements, permits maximum operating efficiency. Another feature is the use of two-speed traverse motors; maximum speed for approximate positioning, and slow speed for extremely close power positioning of the heads. In many cases manual movement in setting up a job is eliminated.

Circle Item 146 on postcard, page 223

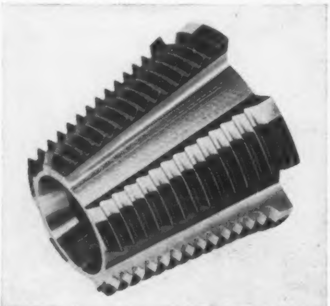
Carbide Tap and Thread-Milling Cutters

Special carbide-tipped and solid carbide taps and thread-milling cutters designed for threading abrasive materials such as aluminum, magnesium, and plastics are now being made by Detroit Tap & Tool Co., Baseline, Mich. These tools are specially engineered to suit the individual application. For example, one of these carbide thread-milling cutters, specially designed for an aluminum threading job, is said to have increased output per sharpening from 750 to 40,000 pieces.

The shell type carbide-tipped thread-milling cutter, Fig. 1, is designed for threading highly abrasive materials. Both solid carbide and carbide-tipped taps such as shown in Fig. 2 are now available.

Circle Item 147 on postcard, page 223

Fig. 1. Shell type carbide-tipped thread-milling cutter made by Detroit Tap & Tool Co.



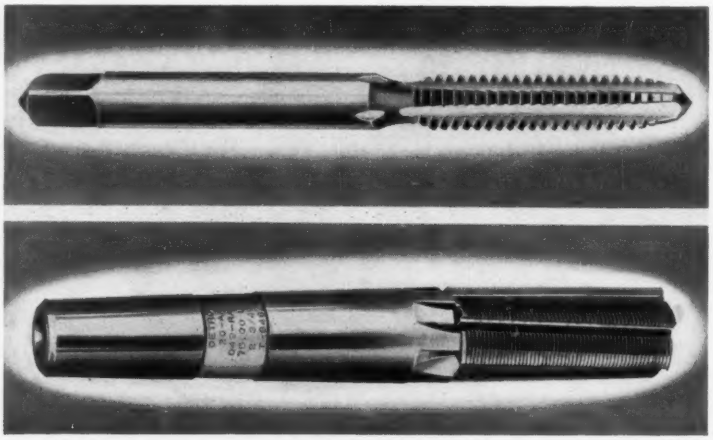


Fig. 2. Typical solid carbide and carbide-tipped taps available from Detroit Tap & Tool Co.

Heliweld Holders for Arc Welding

Air Reduction Sales Co., a Division of Air Reduction Co., Inc., New York City, has brought out a line of manual and machine Heliweld holders for use in the Airco inert-gas tungsten-arc welding process. Lightweight, air-cooled, and water-cooled manual holders and a heavy-duty, water-cooled manual holder, Fig. 1, together with three new water-cooled machine holders, Fig. 2, for automatic and semi-automatic Heliwelding comprise this line.

Models H10-A, H10-B, and H20-A are manual holders; Model H10 is a natural draft, air-cooled holder and H20 is water-cooled. H20 and H10 are rated at 100 amperes, alternating- or direct-current, continuous duty. Model H10-B has built-in thumb-operated gas valve. H20 is rated at 200 amperes, alternating- or direct-current, continuous duty. It is 7 1/2 inches long and weighs 4 ounces. Lava nozzles, collets, and caps are interchangeable. The corn-cob type handle design illustrated is said to reduce operator fatigue. Each holder is equipped with 12-foot hose and cable assembly.

Circle Item 148 on postcard, page 223

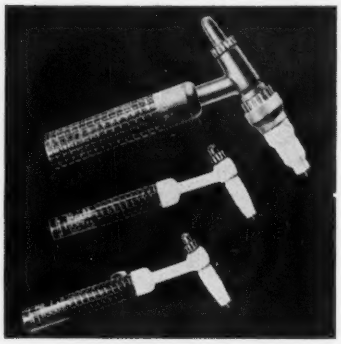
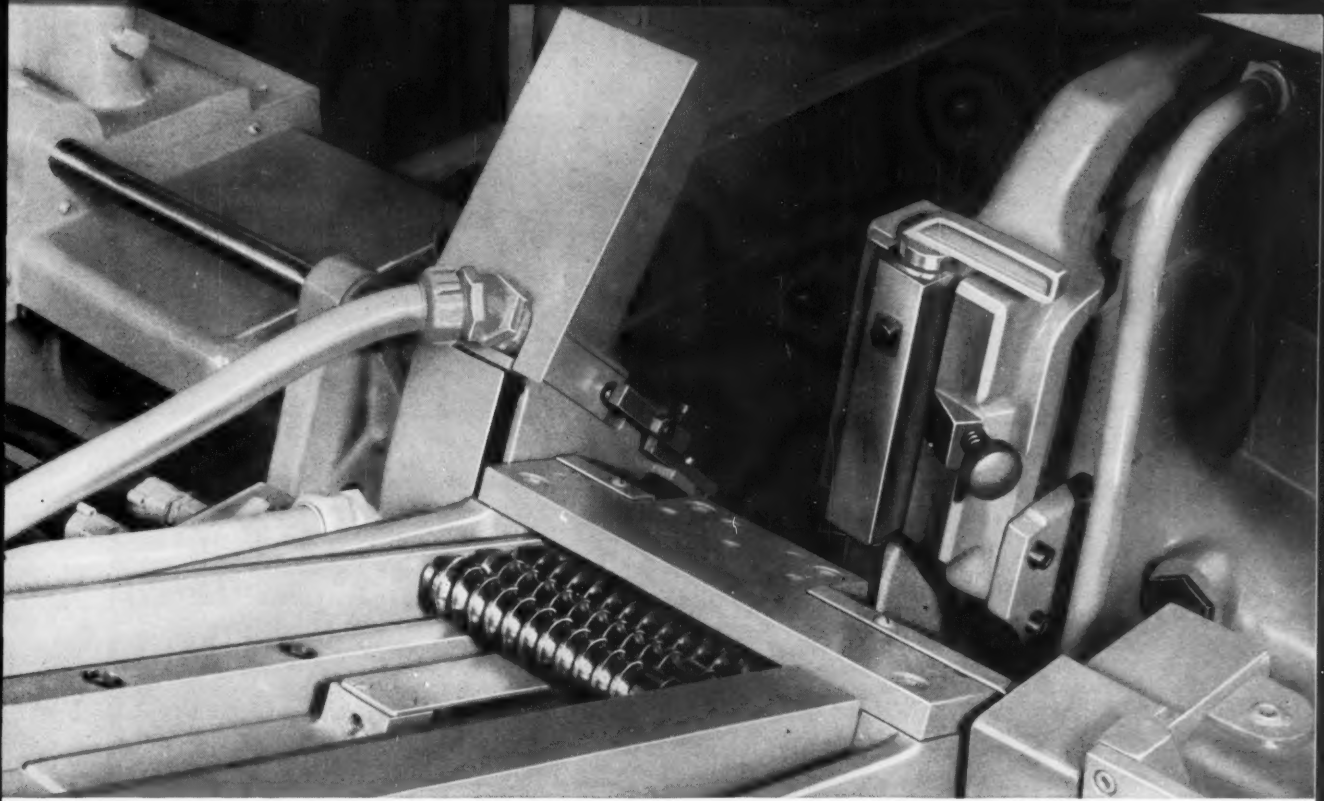


Fig. 1. Heliweld manual holders

Fig. 2. Water-cooled machine holders for automatic and semi-automatic Heliwelding



By E. S. Salichs

BETWEEN

But What a Weapon!

Were you an executive in 1020 B.C., asking your secretary to bring her tablet for dictation would pose a problem. It weighed at least 120 pounds, according to an office equipment manufacturer who went all the way back to the Dark Ages in conducting research to evolve the perfect office suite. Had the researcher come to us, we would have told him the true story of a strong-armed Girl Friday named Miss Glyphics. She was much in demand, and the word went around, Hire Glyphics.

Horse's Holiday

Friend told us he stopped at a small island in the Bahamas and decided on a Saturday morning to go over to the other side of the island. Asked the proprietor of his hotel if a conveyance was available. "We do have a horse and buggy, but the horse is out of town for the weekend," came the reply. Our friend raised his eyebrows slightly, not that he felt that the human race has a monopoly on the custom of weekends but he had never happened to consider this possibility. The explanation was simple, and not shaggy. The island being small, there was not sufficient pasture, so every Saturday morning the owner of the horse took him by boat to a nearby island where the horse grazed until Sunday evening when reclaimed.

Engaging the Ladies

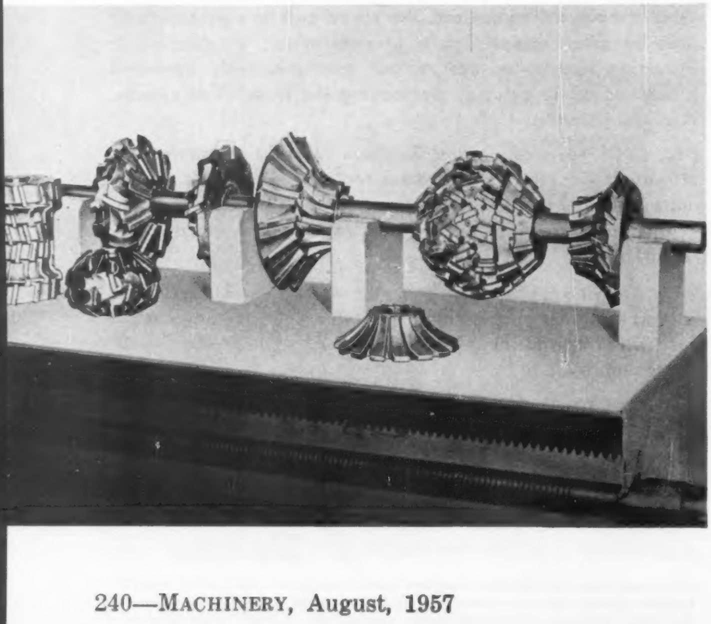
A woman engineer addressing a Pittsburgh educational group blamed the scarcity of women in her profession on "prejudices and misunderstandings," and went on to say that of 120,000 women who received college degrees last year, only sixty-two were graduated in engineering. Let's face it, men: How can we make engineering magnetic to the opposite sex?

"Come and Get It" Now on Wheels

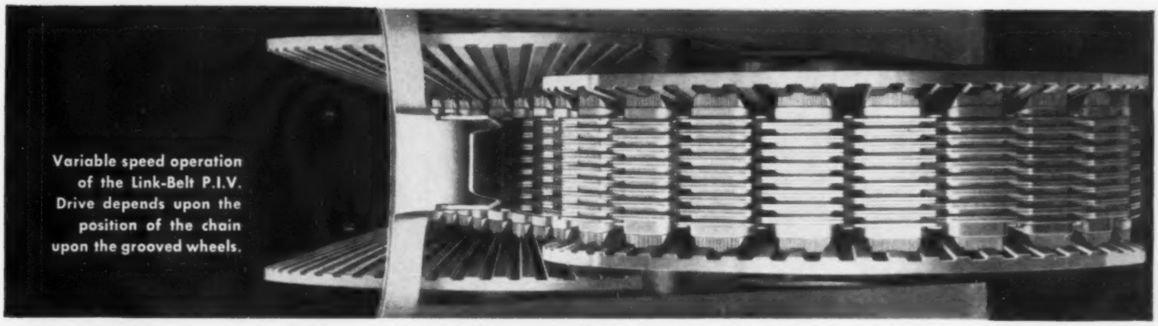
The Dodge Mobilterea is a mobile cafeteria equipped with a hot oven, steam table, coffee urns, refrigerator, and pastry compartments, which will serve complete hot meals to 1000 people in less than two hours' time. Made of stainless steel, the 204-hp. push cart is mounted on a rolling rail within the van of a 1-ton Dodge truck. The unit is intended for use at industrial plants, sporting events, and fairs. Or when junior invites his rock-and-roll crowd to a Saturday night barbecue.

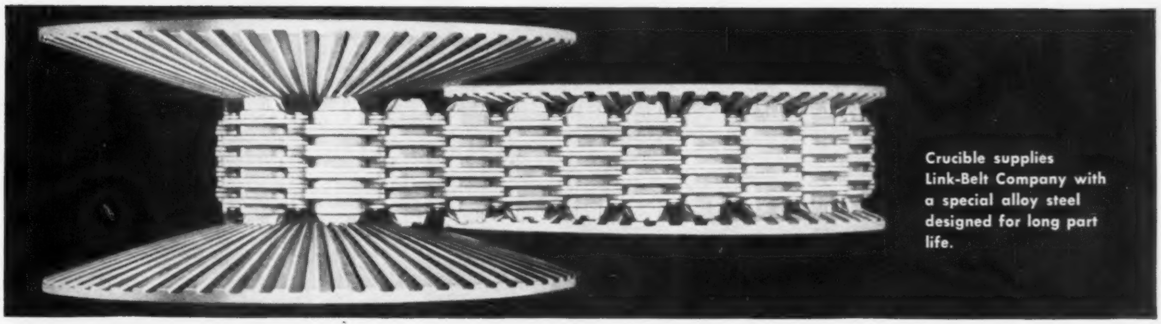
The Horn Hangs High

Automobile horns on Buicks had their pitch changed in 1957, from musical notes E flat and G to F and A, advancing one full tone. Slightly better penetration through road noise was the reason—and through the driver in the car ahead?

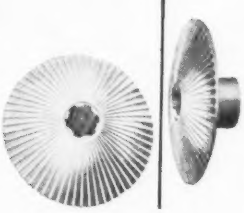


THEY WHITTLED BEFORE THEY WORKED—Engineers at Goddard & Goddard Co., Detroit, Mich., built wooden dummy models of special cutters for milling stainless-steel turbine blades, after receiving a large contract for their manufacture. The resulting cutters proved so successful that their potential machining capabilities were far beyond the capacities of the machines themselves. One machine operator remarked, "Shucks, these cutters ain't working, they're just creeping."





these **SPECIAL ALLOY STEEL PARTS** keep Link-Belt's P.I.V. Drive on the job



Keeping production operations going at the right speed is the job of this variable speed drive unit produced by Link-Belt Company. Its operation is based on an exclusive drive chain with self-forming metal teeth, which engage with radial grooves in two pairs of cone-shaped wheels.

To make these precision wheels requires a steel that can be readily machined, will not distort, and which has high-strength. That's why Crucible furnishes Link-Belt with a special Nitriding BM alloy steel *designed* for this application. After machining the wheels are Nitrided to obtain a minimum surface hardness of 1000 Vickers Diamond Brinnel – about the hardest surface that can be obtained commercially.

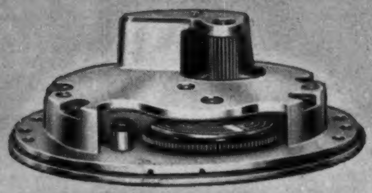
When your application requires a tough, machinable, nondeforming alloy steel – call Crucible. One of our many special alloy grades may be the right one for you – or we can develop one to meet your most exacting demands. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

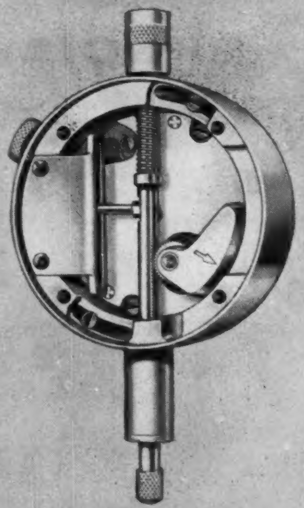
Crucible Steel Company of America

FOUR WAYS TO IMPROVE YOUR GAGING PROGRAM

Front view showing easy-reading dial with contrasting black bezel



Interchangeable gear mechanism features simplified unit construction



View with back removed showing inside mechanism

Starrett® HIGH PRECISION LOW FRICTION Dial Indicators

1 CUT MAINTENANCE

With fewer parts and interchangeable gear assemblies in No. 25, No. 655 and No. 656 sizes, Starrett Dial Indicators cut maintenance costs. You keep more indicators in service longer with fewer spare parts to stock. The entire gear assembly can be removed as a unit for convenience in servicing.

2 IMPROVE ACCURACY

Simplified design with rugged, rigid construction means Starrett Dial Indicators are less subject to friction and wear. Replaceable low friction jeweled or inserted bronze bearings align accurately to eliminate end play. Rustproof stainless steel gears and tempered pinions, stainless and tempered racks and spindles and heavier bridge and case, all make for lasting accuracy.

3 INCREASE EFFICIENCY

New easy-reading dials, satin chrome exterior finish and contrasting black bezels help operators read faster and more accurately with less eye fatigue. Count hands on long range models read directly in decimals . . . no calculations.

4 IMPROVE PERFORMANCE

Direct acting springs completely around the spindle or rack eliminate cocking and side friction. Action is smoother, more accurate, with less contact pressure. And with the new Nonshock mechanism to stop shock *before* it reaches the gear train, Starrett indicators stand up longer even on brutal gaging applications.

SEND THE COUPON *for catalog describing the complete line of Starrett High Precision-Low Friction Dial Indicators.*

Buy through your Industrial Distributor
Prompt delivery
Dependable service
Quality products

Starrett

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

The L. S. STARRETT COMPANY, Dept. ͻ
Athol, Massachusetts

Please send information on Starrett *High Precision-Low Friction* Dial Indicators.

Name.................. Title..........

Company.............................

Street and Number......................

City.............. Zone... State........

For more information fill in page number on Inquiry Card, on page 223

COMPOSITIONS OF UNLISTED COPPER ALLOYS

Wrought Copper Alloys Not Listed in the Copper and Brass Research Association's Manual of Standard Alloys

Trade Name	Material	Nominal Composition, Per Cent	Forms and Applications	Producer
Aluminum Bronze	Aluminum Bronze	Cu 87.00, Zn 7.00, Al 4.00, Fe 2.00	Sheet, strip—Bearings, bushings, thrust washers.	Olin Mathieson Chemical Corporation
Ambraloy—901	Aluminum Bronze, 5%	Cu 95.00, Al 5.00	Tube, rod, bar, sheet, strip, plate, wire—Condenser and heat exchanger tubes, foreign coinage, architectural decoration to imitate gold.	American Brass Co.
Ambraloy—917		Cu 82.00, Al 9.50, Ni 5.00, Fe 2.50, Mn 1.00	Plate, rod, bar, die-pressed forgings—Tube sheets for heat exchangers.	American Brass Co.
Ambraloy—928	Aluminum Bronze, 8%	Cu 92.00, Al 8.00	Sheet, strip, plate, wire, rod, bar—Valve stems, coins, medallions, plaques.	American Brass Co.
Ambronze—421	Tin Brass	Cu 88.00, Zn 10.00, Sn 2.00	Tube—Condensers and heat exchangers.	American Brass Co.
Ambronze—474		Cu 94.97, Zn 4.00, Sn 1.00, P 0.03	Sheet, strip, plate—Electric switch parts and spools.	American Brass Co.
Ampco Grade 8	Aluminum Bronze D	Cu 90.00, Al 7.00, Fe 2.25	Sheet, plate, extruded rod, tube, pipe, shapes—Mechanical and processing fabrications, conveyors, liners, heads, slides, gibs, wear strips.	Ampco Metal Inc.
Ampco Grade 15	Aluminum Bronze	Cu 87.50, Al 9.25, Fe 3.20	Extruded solid and hollow rounds, shapes—Gears, small worm-wheels, bushings, valve seats, guides.	Ampco Metal Inc.
Ampco Grade 18	Aluminum Bronze	Cu 85.50, Al 10.50, Fe 3.50	Extruded solid and hollow rounds, shapes—Bushings, bearings, worms and worm-wheels, valve seats and guides, hydraulic valve parts, plungers, pump rods, guide-pin bushings, gibs, slides.	Ampco Metal Inc.
Avialite—915		Cu 89.25, Al 9.25, Fe 0.60, Ni 0.50, Sn 0.40	Rod, bar—Pickling crates. Used where strength and resistance to corrosion at high temperatures are required, as in parts for internal combustion engines.	American Brass Co.
Brazing Bronze—222		Cu 93.00, Zn 4.70, Fe 2.30	Sheet, strip—Retains fine grain size up to about 1600-1700 degrees F. Used for furnace brazing, electrical applications such as circuit breaker arms, terminals.	Olin Mathieson Chemical Corporation

Based on Copper and Brass Research Association Data

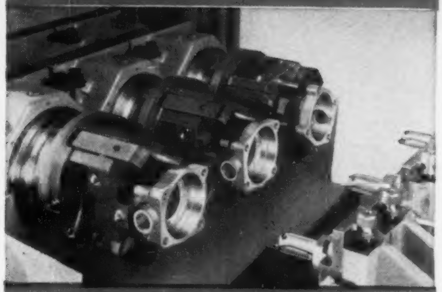
COMPOSITIONS OF UNLISTED COPPER ALLOYS (Cont.)

Wrought Copper Alloys Not Listed in the Copper and Brass Research Association's Manual of Standard Alloys

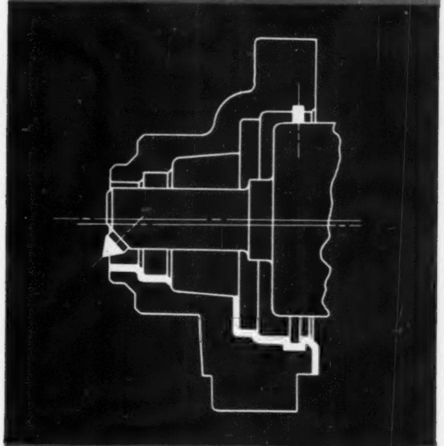
Trade Name	Material	Nominal Composition, Per Cent	Forms and Applications	Producer
Calsun Bronze		Cu 95.50, Al 2.50, Sn 2.00	Wire—Wire and cable for electrical conductors.	American Brass Co.
Chromium Copper—999		Cu 99.05, Cr 0.85, Si 0.10	Sheet, strip, plate, wire, rod, bar—Switches, circuit breakers, contact points on resistance welding electrodes, grid supports, vacuum tubes.	American Brass Co.
Contact Bronze—92	Tin Brass	Cu 89.00, Zn 8.20, Sn 1.80	Strip—Electrical and radio spring applications.	Bridgeport Brass Co.
Duronze—707	Aluminum Silicon Bronze	Cu 91.00, Al 7.00, Si 2.00	Rod, bar—Valve stems and parts, wire and cable connector parts, bolts and nuts, hot-forged parts, marine hardware, gears, pinions. Good corrosion resistance.	Bridgeport Brass Co.
Everdur—1012	Leaded Silicon Bronze	Cu 95.60, Si 3.00, Mn 1.00, Pb 0.40	Rod—Screw machine products.	American Brass Co.
Everdur—1014	Aluminum Silicon Bronze	Cu 90.75, Al 7.25, Si 2.00	Rod—Screw machine parts, die-pressed forgings.	American Brass Co.
Forgeable Bearing Alloy 600		Cu 58.00, Zn 37.25, Mn 2.50, Al 1.50, Si 0.75	Forgings, rod—Screw machine products, chain saw clutch bearings, automotive transmission synchronizing rings, pyrometer bearings, squirrel cage feed fingers, hydraulic pump driving cams, lead-screw nuts.	Mueller Brass Co.
Free-Cutting Manganese Bronze (A), Leaded		Cu 59.00, Zn 38.30, Sn 0.90, Fe 0.90, Pb 0.70, Mn 0.20	Rod forgings—Valve parts, marine hardware.	Titan Metal Co.
High-Leaded Bearing Alloy 604		Cu 61.00, Zn 33.00, Mn 2.50, Pb 2.50, Si 1.00	Rod—Screw machine products	Mueller Brass Co.
High-Silicon Brass	High-Silicon Brass	Cu 81.00, Zn 15.00, Si 4.00	Rod, die-castings, forgings—Valve parts, pole line hardware.	Titan Metal Co.

(This table to be continued in a coming number of MACHINERY*)*

Based on Copper and Brass Research Association Data



Showing parts mounted in the chuck. Without chuck changes, any of three parts having different exterior forms but identical interior contours can be accommodated.



12 operations are performed in one machine cycle. Heavy lines denote surfaces machined.

Intricate contouring is fast, accurate—

12 operations in one cycle!

Direct cam action—no levers—provides Ex-Cell-O Precision Boring Machines with accuracy, versatility and speed in difficult contouring operations.

In the application shown here—contouring an internal form in die-cast aluminum end covers—limits on diameters are held as close as plus or minus .0005 inch, and three work pieces are completed at a time. 12 separate operations are performed in one machine cycle, including precision boring, facing, chamfering and grooving.

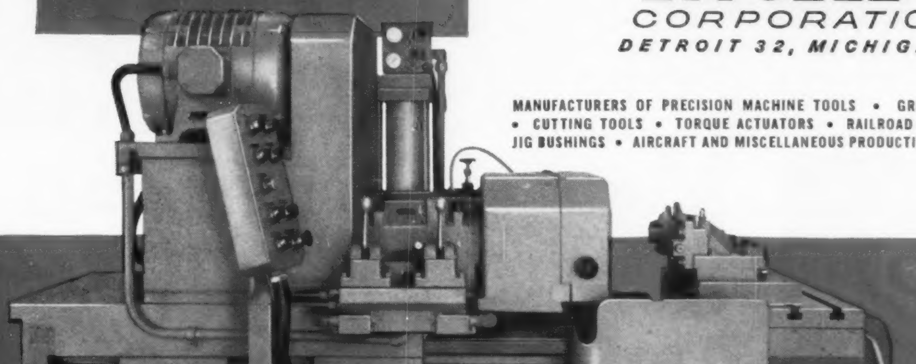
Cams can be changed in minutes. Cam assembly swings out for quick, easy change. All motors are outside the base.

Another Ex-Cell-O feature is the large chip chute, cast as an integral part of the base. There are no openings where chips or coolant can enter the base. Contact your Ex-Cell-O representative or write direct for complete information.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

57-62



XLO

EX-CELL-O FOR PRECISION

At left: The Ex-Cell-O Styled 312 Cam Operated Precision Boring Machine. A smaller model, the Ex-Cell-O Style 308, is also available because of the demand for this type of machine.

News OF THE INDUSTRY

Illinois and Wisconsin

SCULLY-JONES & CO., Chicago 8, Ill., announce the appointment of the following distributors: CUTTING TOOLS, INC., 624 N. Skinker Blvd., St. Louis, Mo., to cover the St. Louis territory; OLIVER H. VAN HORN CO., INC., 1742 St. Charles Ave., New Orleans, La., to cover Mobile, Alabama, and Jackson, Miss., through branches located at 111 Beauregard in Mobile and 451 N. Gallatin St. in Jackson; FARQUHAR MACHINERY CO., 2120 Market St., Jacksonville, Fla., to cover the Jacksonville territory; GARRETT SUPPLY DIVISION of the GARRETT CORPORATION, 3844 S. Santa Fe Ave., Los Angeles, Calif., to cover the southern half of the state plus Arizona; and SCHULTZ INDUSTRIAL SUPPLY CO., 2826 Niles Ave., St. Joseph, Mich., to cover the Benton Harbor area.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announce the following appointments: FREDERICK B. WINTHER, JR., was named manager of sheet and strip sales at the company's Cincinnati steel service plant. He formerly held a similar position at the company's Milwaukee plant. He replaces WILLIAM F. DAGON, who has been transferred to the new Ryerson plant in Indianapolis. FRANK W. INGOLD has been named to the newly created post of sales manager for the Cincinnati steel service plant. Mr. Ingold started with the company in 1940 in the stock records department. He continued his progress through the work order department and became a general salesman in 1949. Succeeding Mr. Ingold, a sales representative in the Ohio territory is ELMER A. JAHNKE, JR.

THEODORE F. MUMMERY, JR., has been appointed manager of cutting tool sales for the Besly-Welles Corporation, South Beloit, Ill. Mr. Mummery has been associated with the company since 1947. He first worked at the company's Chicago office and later served as district manager of the Cleveland branch office and warehouse.

DONALD M. McDOWELL has been named manager of engineering for the LE ROI DIVISION, Westinghouse Air Brake Co., Milwaukee, Wis.

New England

NILS LINDSTROM has been appointed superintendent of the Tool Division of Moore Special Tool Co., Inc., Bridgeport, Conn.

(Left) Frederick B. Winther, Jr., manager of sheet and strip sales, and Frank W. Ingold, sales manager, both of the Cincinnati Steel Service plant of Joseph T. Ryerson & Son, Inc.

CARL O. LARSON has been appointed superintendent of the Machine Division of Moore Special Tool Co., Inc., Bridgeport, Conn., to succeed Hadar Wahlquist, who is retiring.

ROBERT C. WRIGHT has been promoted to chief, production engineering at Pratt & Whitney Aircraft, East Hartford, Conn. He has been with the company since 1942.

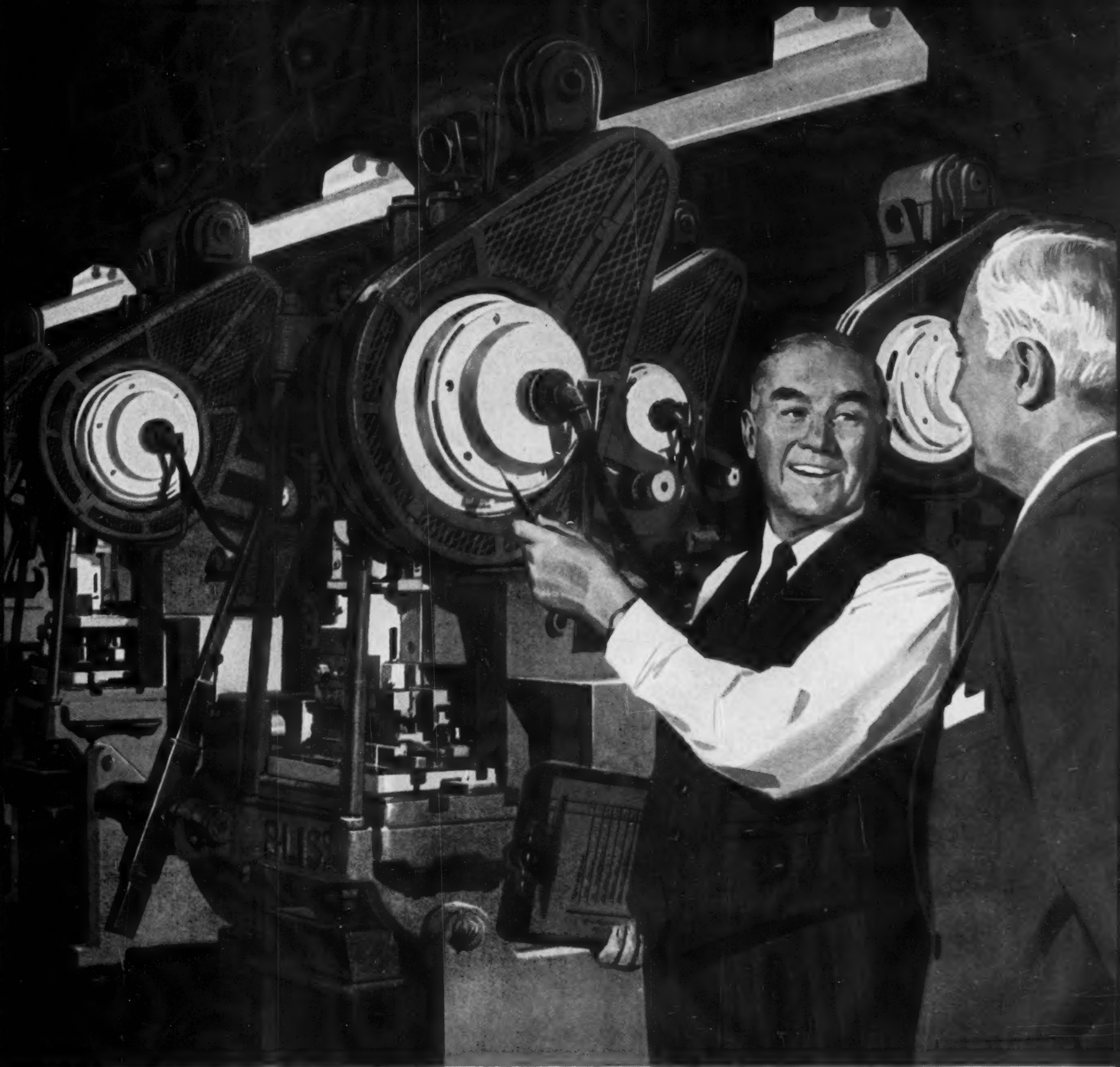
JOHN R. HANCOCK has been appointed field sales representative in several Southern states for the Allen Mfg. Co., Hartford, Conn.

NORTON CO., Worcester, Mass., announces the following appointments: MYLES A. SNYDER has been assigned as abrasive engineer in Chicago. J. ZACH HIGGS was appointed resident manager of the company's Huntsville, Ala., electric furnace plant. EDWIN R. REED has been appointed California district sales and service engineer. JOHN E. TAYLOR has been appointed abrasive engineer for the Toledo, Ohio, area. PAUL A. BISNETTE has been appointed field engineer, Los Angeles district. PETER IAFFALDANO has been appointed field engineer in the Cleveland district. Norton has also established two new district offices, one in Atlanta, Ga., and the other in Indianapolis, Ind. NORMAN R. EKHOLM has been appointed district manager in Atlanta and JOHN R. H. TRUELSEN will assume the same post in Indianapolis.

SAMUEL A. LEONE has been named sales manager, Special Products Division of the Colson Corporation, Somerville, Mass.

NIAGARA MACHINE & TOOL WORKS, Buffalo, N. Y., announces the establishment of a Boston district office at 500 Main St., Waltham, Mass. ROBERT F. GAYLORD has been appointed manager.

MINIATURE PRECISION BEARINGS, INC., Keene, N. H., has announced the acquisition through merger of the SPLIT BALLBEARING CORPORATION, Lebanon, N. H.


BLISS

(Left) E. P. Bullard III, president and general manager, and E. C. Bullard, chairman of the board and chief executive officer of Bullard Co.

BULLARD Co., Bridgeport, Conn., announces the elections of E. C. BULLARD as chairman of the board and chief executive officer, and E. P. BULLARD III as president and general manager. E. C. Bullard has been a director of the company since 1930 and president and general manager since 1946. He was first employed by the company in 1917 and, with the exception of one and one-half years of war service, has been continuously with the company, becoming vice-president and general manager in 1931. E. P. Bullard III is a grandson of Edward Payson Bullard, who founded the company in 1880, and the son of E. P. Bullard, Jr., second president of the company from 1907 to 1946. He served the company in many executive capacities from 1933 to 1951, including that of assistant chief engineer, vice-president in charge of manufacturing, and vice-president and assistant general manager. Since 1951, while continuing to serve as a Bullard director, he has been an executive of Pratt & Whitney Aircraft Division, United Aircraft Corporation.

BROWN & SHARPE MFG. Co., Providence, R. I., announces the following changes in its machine tool and industrial products field sales organization: New England—offices have been opened at 65 Auburn St., Auburn, Mass. HERBERT RICHARDSON is district manager for machine tools, and RUSSELL O. NEWTON, industrial sales manager for industrial products. Ohio—offices have been consolidated at 1577 W. 117th St., Cleveland. W. H. STEWART is district sales manager for machine tools and F. L. PRITCHARD, for industrial products. West Coast—headquarters for the company's district sales office are at 3040 E. Olympic Blvd., Los Angeles. VERNON L. WADE, sales manager in industrial products, and JOHN A. RINEK, for machine tools.

New York and New Jersey

ROBERT M. BRINEY has been appointed president of Haynes Stellite Co., Division of Union Carbide Corporation, New York City. Mr. Briney started with the corporation in 1924 in the Niagara Falls, N. Y., plant of Electro Metallurgical Co., also a division of Union Carbide.

JAMES C. MABE, manager of plant operations, Chicago Pneumatic Tool Co., New York City, was elected a vice-president. All manufacturing and engineering operations in the company's domestic plants—Utica, N. Y.; Franklin, Pa.; Fort Worth, Tex.; Garfield, N. J.; and Hartford, Conn.—will come under his jurisdiction. His headquarters will continue to be in the home office in New York City. Mr. Mabe joined Chicago Pneumatic Tool Co. in 1955 as plant manager.

James C. Mabe, vice-president, Chicago Pneumatic Tool Co.

LEONARD W. LINDH has succeeded ROBERT L. ARMS as sales representative for Consolidated Machine Tool Division of Farrel-Birmingham Co., Inc., Rochester, N. Y., in the territory comprising New Jersey, eastern Pennsylvania, Delaware, and Maryland.

LINK-BELT Co.'s New York district office has moved into new and larger quarters at 530 Fifth Ave., New York City. The company's New York export offices will remain at 233 Broadway, New York City.

PAUL P. SUITER has been appointed Chicago regional manager of Lamson Corporation, Syracuse, N. Y. Mr. Suiter has been associated with the company for more than twenty-five years.

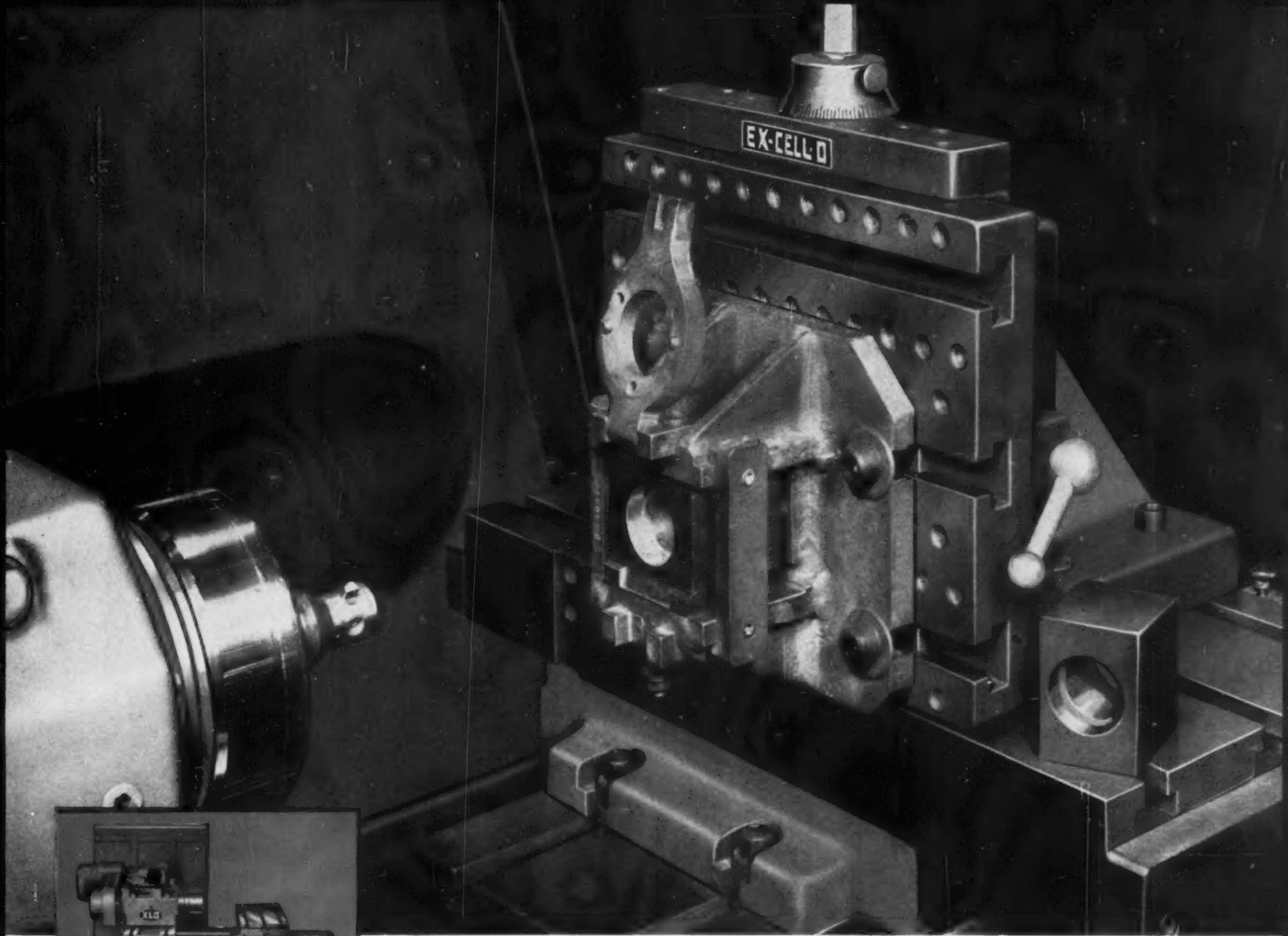
HUB CITY FACTORY SUPPLY Co., Liverpool, N. Y., has been appointed agent for the central New York State area, including Syracuse and Utica by the Cleveland Punch & Shear Works Co.

JOHN C. SPRAGUE, secretary-treasurer of Acheson Industries, Inc., New York City, has been elected vice-president in charge of administration and finance.

JOHN P. DELANEY has been appointed a vice-president of Alco Products, Inc., Schenectady, N. Y.

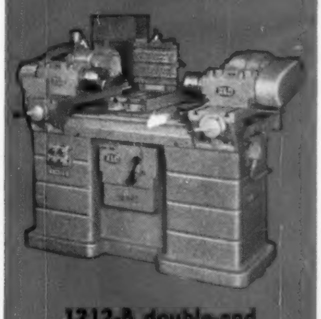
BOICE GAGES, INC., Hyde Park, N. Y., announces the purchase of the assets of the Nilsson Gage Co., Inc. Poughkeepsie, N. Y.

ALLOY TUBE DIVISION of the Carpenter Steel Co., Union, N. J., announces the appointments of ROBERT M. KEARNS and BARCLAY MORRISON as managers of two new departments. Mr. Kearns, formerly engineering and methods manager, has been named manager of the division's engineering and planning department. Mr. Morrison, who was specialty products manager, is now manager of the product engineering and development department. JAMES P. KELLEHER, formerly assistant specialty products manager, was named assistant product engineering and development manager. WILBUR J. COMERFORD and L. CARL OSELAND will serve as product engineers in the same department. Mr. Kearns



Close-up view of Ex-Cell-O Precision Boring Machine equipped with a single spindle and a universal fixture for small lot production.

2112-B single-end Ex-Cell-O Precision Boring Machine with horizontal cross slide fixture.



1212-B double-end Ex-Cell-O Precision Boring Machine with universal fixture having cross and vertical slides.

These versatile machines keep busy

Ideal machines for toolroom work and short production runs

These Ex-Cell-O Precision Boring Machines equipped for general-purpose work perform precision boring, turning, facing and chamfering operations quickly and economically.

They can be operated automatically or manually. Spindle speeds are easily changed through variable speed drives. Universal fixtures rigidly hold tools and workpieces of many sizes and shapes. Horizontal and vertical slides of the fixtures permit precision positioning of either tools or work.

Ex-Cell-O makes a complete line of versatile precision boring machines.

EX-CELL-O CORPORATION

EX-CELL-O FOR PRECISION

XLO

DETROIT 32, MICHIGAN MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

56-63


(Left) Robert M. Kearns, manager of engineering and planning department, and Barclay Morrison, manager of product engineering and development department, Alloy Tube Division, Carpenter Steel Co.

Frank A. Depweg, manager of special product sales, Hamilton Division, Baldwin-Lima-Hamilton Corporation

has been with the company for the past eleven years and Mr. Morrison has been with the division for ten years.

Dr. Shadburn Marshall has been appointed director of metallurgical research at Air Reduction Co.'s central research laboratories, Murray Hill, N. J.

Ohio and Michigan

William F. Bohannan has been appointed field research engineer of Denison Engineering Division, American Brake Shoe Co., Columbus, Ohio.

S. C. Stratton has been appointed vice-president in charge of manufacturing, Fageol Products Co., Kent, Ohio.

Robert T. Loudon has been appointed sales manager, Machine Tool Division of Baker Brothers, Inc., Toledo, Ohio. He has fifteen years experience as a sales executive with several of the country's leading machine tool builders.

Charles E. Huddleston has been appointed director of engineering at the Lewis Welding & Engineering Corporation, Cleveland, Ohio.

Walter E. Callison has been named manager of Brehm Die Division of Vulcan Tool Co., Dayton, Ohio. Prior to joining the company, he was an assistant manager at Steel Products Engineering Co.

Dr. James A. Krumhansl has been named associate director of the Parma Research Laboratories of National Carbon Co., Division of Union Carbide Corporation, Parma, Ohio.

Swanson Machinery Co., Grand Rapids, Mich., has been appointed representative of the Nebel Machine Tool Corporation.

Cincinnati Gear Co., Cincinnati, Ohio, announces the following appointments: Walter L. Rye has been appointed plant manager; Lester A. Edwards has been named sales manager in charge of the company's sales representatives; and Anthony J. Lucas has been made chief engineer in complete charge of methods, tooling, purchasing, and engineering.

Dvorak Machinery Co., 7001 W. North Ave., Oak Park, Ill., has been appointed distributor in the Chicago area for the Hamilton Tool Co., Hamilton, Ohio.

Harvey J. Corrin, vice-president of the Cleveland Punch & Shear Works Co., Cleveland, Ohio, has announced his retirement after fifty-six years of service with that company. He will continue to serve as a member of the board of directors.

R. K. Hoffman, manager of the Engineered Products Division of Acme Precision Products, Inc., Dayton, Ohio, has been named a vice-president of that company.

Bernard S. Reckseit has been named vice-president in charge of engineering of Ransohoff, Inc., Hamilton, Ohio.

Frank A. Depweg has been appointed manager of a newly created sales department—special product sales—at the Hamilton Division of Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. As department manager, Mr. Depweg will be responsible for sales of glass machinery, foundry products, subcontract work, and general jobbing. It was also announced that Howard Matre has been named sales engineer. He was formerly responsible for diesel engine renewal parts.

Robert A. Schafer has been appointed vice-president in charge of engineering of Baker Brothers, Inc., Toledo, Ohio. Mr. Schafer is a recognized authority on metal cutting and has been responsible for a number of outstanding developments in that field. Prior to his present appointment, he was an engineering executive with National Automatic Tool Co. In his new position, Mr. Schafer will be in complete charge

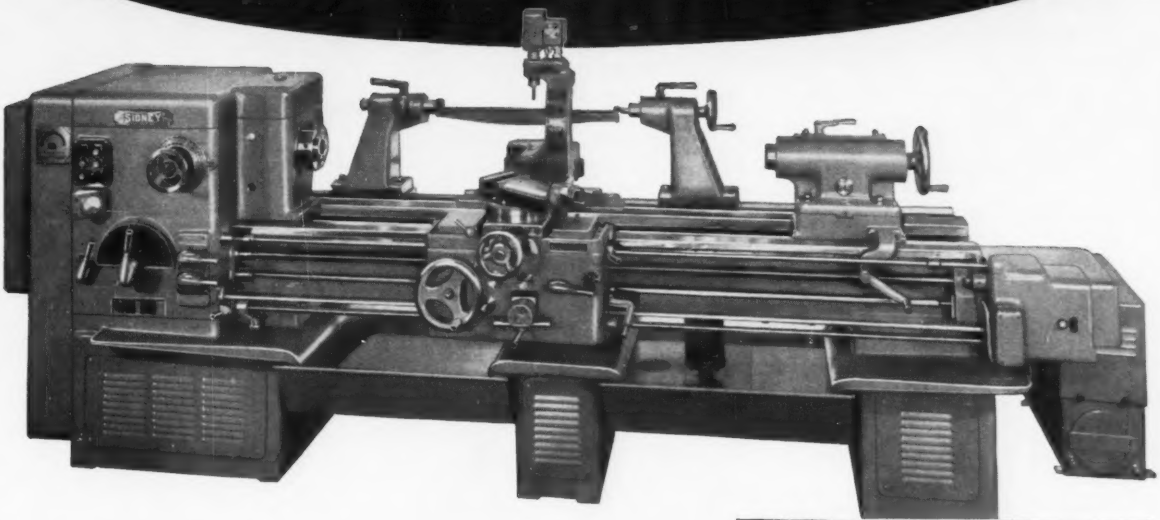
Robert A. Schafer, vice-president of engineering, Baker Brothers, Inc.

for Limited or Large Production...

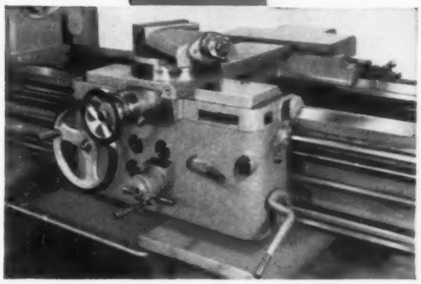
IT PAYS TO USE

SIDNEY

MODEL 32
DIAL-MASTER
WITH FLUID TRACER



On small or limited production these lathes give you an infinitely precise cutting job . . . on large or extended runs the SIDNEY FLUID TRACER just keeps on and on turning as many pieces as you need (the sky is the limit) with uniform precision, speed and economy. Change-over to standard lathe operation or back to tracer work requires just a few seconds without adding or removing any parts.

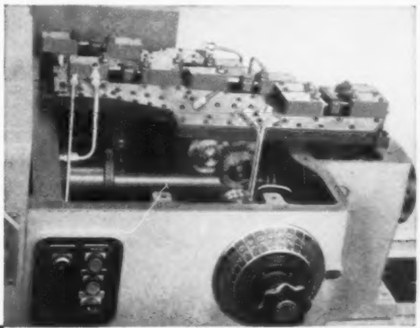


Single lever control carriage and apron
For both standard longitudinal and crossfeed as well as 4-way rapid traverse. Built-in thread chasing dial is convenient to operator's vision.

Note This: **THE SIDNEY DIAL-MASTER WITH FLUID TRACER PRODUCES 300% MORE WORK THAN ANY OTHER LATHE WITH CORRESPONDING SAVINGS IN TIME AND COST PER PIECE**

30 or more hydraulically controlled pre-selective spindle speeds . . . simple . . . versatile . . . accurate

Write for new bulletin or ask for representative to call at your convenience.



Shift to any speed in only 2 seconds
Smooth — swift — sure! Change in speeds is AUTOMATIC by hydraulically actuated shifter mechanism with the engagement of the control lever.

THE SIDNEY MACHINE TOOL CO., SIDNEY, OHIO
Builders of Precision Machinery since 1904

For more information fill in page number on Inquiry Card, on page 223

of engineering and will play an important part in the company's new expansion program.

COLONIAL-ROMULUS DIVISION, Colonial Broach & Machine Co., Detroit, Mich., announces the appointments of three companies as representatives. ALLIED NORTHWEST MACHINE TOOL CORPORATION, 1222 S. E. 7th St., Portland, Oreg.; ANDERSON MACHINE TOOL CO., 2631 University Ave., St. Paul 14, Minn.; and R. H. BRITTON MACHINERY SALES, 3570 Burnet Ave., East Syracuse, N. Y.

JOSEPH M. GEBEL has been appointed manager of the Detroit office of R. K. LeBlond Machine Tool Co. Since joining the company in 1923, Mr. Gebel served as an apprentice, service engineer, and sales engineer. For the past eleven years he has been in the Detroit office.

Joseph M. Gebel, manager of the Detroit office of R. K. LeBlond Machine Tool Co.

FELIX ZAWASKI has been appointed plant manager of the Gear-O-Mation Division of Michigan Tool Co., East Detroit, Mich. In his new capacity, Mr. Zawaski will direct much of the expanding work of the division in the automation equipment field.

DONALD F. LEVLEIT has been appointed general manager of Veet Industries, East Detroit, Mich. He was formerly factory manager of the Detroit plant of the Continental Motors Corporation.

THOMAS M. WHEELER was named assistant secretary-treasurer of Wesson Tool Co. and its subsidiary, Wesson Co., Ferndale, Mich., and Wesson Multicut Co., Brighton, Mich.

Pennsylvania and Maryland

LATROBE STEEL CO., Latrobe, Pa., announces the following appointments: W. G. DAHL has been named eastern regional sales manager. L. M. TEICH has been transferred to the company's Hartford branch office, and J. G. GOODRICH has been promoted to district sales manager of the company's Philadelphia branch office.

FREDERICK D. FERNSLER has been named manager of the newly formed nut department in the Aircraft Division of Standard Pressed Steel Co., Jenkintown, Pa. Mr. Fernsler, formerly manager of the company's Unbrako inside sales department, will be responsible for sales of both industrial and aircraft lock-nuts and for development of all new standard and special nut types to consolidate all Standard Pressed Steel nut sales and development within one department.

Frederick D. Fernsler, manager of the nut department, Aircraft Division, Standard Pressed Steel Co.

SKF INDUSTRIES, INC., Philadelphia, Pa., announces the acquisition of TYSON BEARING CORPORATION, Massillon, Ohio.

STANDARD PRESSED STEEL CO., Jenkintown, Pa., announces the following appointments: CHESTER C. LONSDALE, assistant to the superintendent, has been named superintendent of the company's Hallowell Division and BENNETT D. JONES, formerly manager of product development, will act as technical director in the company's Aircraft Division.

RALPH A. PETERSEN has been appointed manager of the Birmingham, Ala., district office of Pangborn Corporation, Hagerstown, Md. Mr. Petersen recently joined the corporation as a sales engineer assigned to the home office in Hagerstown, Md. He now has the states of Alabama, Mississippi, and eastern Tennessee as his territory. The new district office is located at 1731-C Valley Ave.

Ralph A. Petersen, district manager for Pangborn Corporation

Ninety Years Young

Keuffel & Esser Co., Hoboken, N. J., has recently marked its ninetieth anniversary. Founded in 1867 by Wilhelm Keuffel and Hermann Esser, the firm sold imported equipment to the nation's embryo engineering profession. Within three years, a small plant had been established to make hard-rubber triangles and T-squares in quantity. Today, K & E is one of the world's leading manufacturers of engineering supplies.

Air Reduction Expands Research Facilities

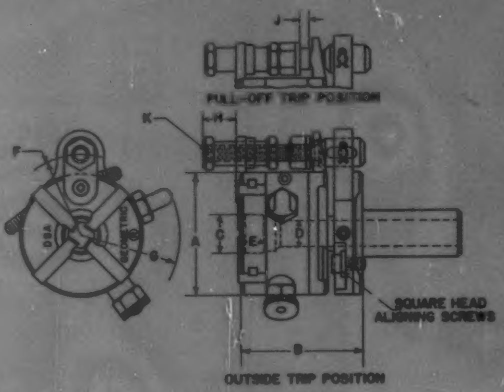
A two-story polymer laboratory is being built to house additional chemical facilities at the research laboratories of Air Reduction Co., Inc., Murray Hill, N. J. The laboratory will be devoted to the development of polymers primarily for paints, adhesives, plastics, and coatings.

The Murray Hill Laboratories were completed in 1947, and Airco is engaged in a diversified research program aimed at the development of new products and processes, as well as new uses for existing products. Metallurgical activities include many phases of arc-welding research and the development of customer-use processes.

Making the best...BETTER

NEW Geometric Convertible self-opening die head with aligning shank

1. Ease of assembly and disassembly.
2. Improved driving construction for freer and smoother operation.
3. Improved locking bolt and segment providing greater wear life.
4. Tongue and groove drive between cam spring plate and skeleton.
5. More rugged construction of small parts — new and heavier stop plunger, larger adjusting screws (Hollow Hex), heavier tripping mechanism, larger cam spring plate screws — without increase in size or weight of die head.
6. Flatted construction of backpart and shank (permitting the die head to be installed as close to the turret as possible without interference).
7. Better interchangeability of parts.
8. Present DS chasers interchange in New "DSA" Model.



There is no better Die Head available for use on Brown and Sharpe and other small screw machines of either the automatic or hand type than the *NEW* Geometric convertible self-opening style DSA Die Head.

The *NEW* DSA comes with an aligning shank which permits adjustment for machine misalignment. It is equipped, also, with both Outside Trip for short length, fine pitch shoulder threading and a Pull-Off Trip for threading lengths providing ample chaser engagement for tripping. Conversion from one trip to the other is quick and simple. The DSA is especially recommended for cutting fine pitch threads of short lengths.

An outstanding Die Head that is really *rugged, requires minimum attention* and is *easier to adjust*, the DSA now joins the Geometric family of the best in precision threading tools.

SPECIFICATIONS — STYLE DSA *For the present the DSA is available in 5/16" size*

Style and Size Inches	MACHINE USED ON	CAPACITY Str. Threads			Std. Pipe	Code Word	A	B	C	D	E	F	G	H	J	K	Standard Shanks†			Max. Shanks Without Bushings		Chasers	Net Wt. Std. Shk. for B. & S. Mach.
		Dia.	§ Lgt.	Coarsest Pitch													Dia.	Lgt.	Bore	Dia.	Lgt.		
DSA 5/16	00 and 00G-B. & S. Auto. 0-B. & S. Wire Feed & Hand Cleveland S.S.	1/16 to 5/16	1¼	18	None	Lesab Lesac Lesad Lesae	1⅝	1⅝	33/64	11/32	11/32	1 1/16	1 5/16	Max. 15/32 Min. 5/16	Max. ⅛ Min. 0	#12-28 N.F.	⅝ ¾ ⅞ 1 1/16	1 5/16 6 6 6	11/32 Solid Solid Solid	⅝ 1 1/16	1 5/16 6	4	13 oz.

§ Length that can be cut when shank is solid.
† Special Shanks furnished at extra cost.

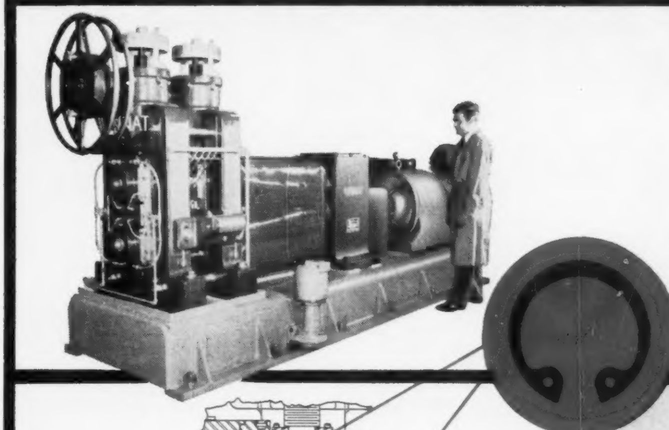
WRITE TODAY FOR FURTHER INFORMATION OR SEE YOUR LOCAL INDUSTRIAL DISTRIBUTOR

GEOMETRIC TOOL COMPANY DIVISION

GREENFIELD TAP AND DIE CORPORATION

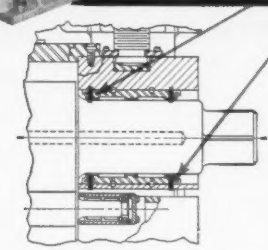
NEW HAVEN 15, CONNECTICUT

7-inch Waldes Truarc retaining rings cut costs, speed assembly-disassembly of 2-high/4-high mill

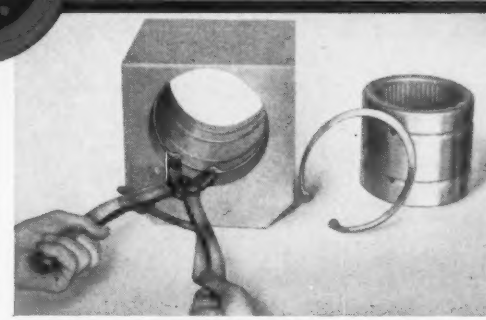


New Model TA-625 2-high/4-high combination rolling mill designed by Stanat Manufacturing Co., Long Island City, N. Y., reduces 2½" ingot to precision-rolled strip as thin as .001".

Waldes Truarc retaining rings help make possible a complete change of work rolls in 20 minutes... solve difficult problems of accuracy control by achieving positive location of bearings to extremely close tolerances. Rings eliminate costly parts and machining, save space, reduce maintenance.



In the assembly illustrated above, 7" Waldes Truarc (Series 5000) retaining rings—three on each roller—are used to position heavy-duty needle bearings in the bearing housing. Smaller rings position bearings in other roller assemblies and retain the shaft of a dual handwheel screwdown. All in all, 18 Waldes Truarc rings are used in the mill. They replace machined shoulders, spacers and lock nuts... eliminate costly threading, other machining operations.



Assembly is simple, even with giant 7" diameter Truarc ring. Special Truarc ratchet pliers grasp the ring securely, ease it into the groove, snap it securely into position. Smaller pliers and various high-speed assembly jigs are available for other rings, permit assembly-disassembly to be performed rapidly even by unskilled labor.

Whatever you make, there's a Waldes Truarc Retaining Ring designed to improve your product... to save you material, machining and labor costs. Quick and easy to assemble and disassemble, they do a better job of holding parts together. Truarc rings are precision-engineered and precision-made, quality controlled from raw material to finished ring.

36 functionally different types... as many as 97 different sizes within a type... 5 metal specifications and 14 different finishes. Truarc rings are available from 90 stocking points throughout the U.S.A. and Canada.

More than 30 engineering-minded factory representatives and 700 field men are available to you on call. Send us your blueprints today... let our Truarc engineers help you solve design, assembly and production problems... without obligation.

For precision internal grooving and undercutting... Waldes Truarc Grooving Tool!

WALDES TRUARC® RETAINING RINGS

Waldes Kohinoor, Inc., 47-16 Austel Place, L.I.C. 1, N.Y.
Please send the new supplement No. 1 which brings Truarc Catalog RR 9-52 up to date.

(Please print)

Name ....

Title ....

Company ....

Business Address ....

City .... *Zone* ...... *State* M089

WALDES TRUARC Retaining Rings, Grooving Tools, Pliers, Applicators and Dispensers are protected by one or more of the following U. S. Patents: 2,382,948; 2,411,426; 2,411,761; 2,416,852; 2,420,921; 2,428,341; 2,439,785; 2,441,846; 2,455,165; 2,483,379; 2,483,380; 2,483,383; 2,487,802; 2,487,803; 2,491,306; 2,491,310; 2,509,081; 2,544,631; 2,546,616; 2,547,263; 2,558,704; 2,574,034; 2,577,319; 2,595,787, and other U. S. Patents pending. Equal patent protection established in foreign countries.

For more information fill in page number on Inquiry Card, on page 223

structurally homogeneous

PARKER-KALON stress relieved socket screws

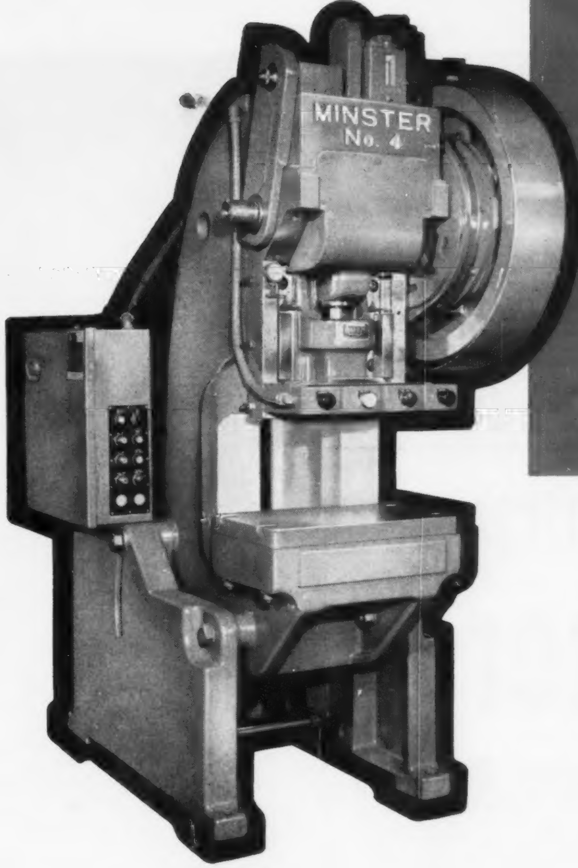
After controlled heating and equally controlled uniform quenching imparting maximum strength, P-K Socket Screws are carefully tempered to assure ductility, proper elongation and high impact strength. This is your assurance that . . . *If it's P-K . . . It's O-K!*

PARKER-KALON DIVISION, General American Transportation Corporation • Manufacturers of Socket Screws, Self-tapping Screws, Screwnails, Masonry Nails, Wing Nuts and Thumb Screws.

Sold Everywhere Through Leading Industrial Distributors — Factory: Clifton, New Jersey • Warehouses: Chicago, Illinois; Los Angeles, California

PARKER-KALON®
fasteners

For more information fill in page number on Inquiry Card, on page 223



You Helped Design The Improved

MINSTER O.B.I.

You, as a press user, have often told us what features *you* wanted in an O.B.I. to improve *your* press operations. Most of the design changes in this improved Minster O.B.I. are based on *your* ideas, desires and demands.

CENTRALIZED CONTROL CABINET CONVENIENTLY LOCATED . . . NEVER INCLINES

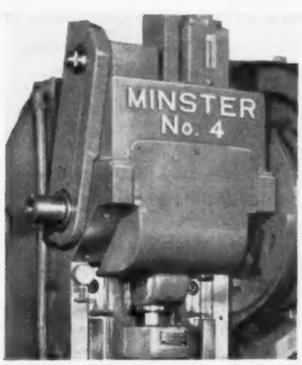
For convenience and better operation, control cabinet mounted on leg remains vertical when press is inclined; is subject to less operational shock and easier to maintain.

NEW LEG DESIGN PROVIDES MORE WORKING SPACE

Square-cut legs give operator more room, a comfortable position in front of press. Inclining mechanism in leg and use of movable spacer rod provide more free space under press for tote pans or conveyors.

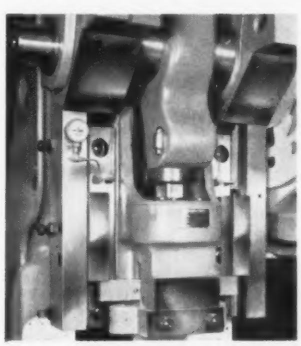
NUMBER	4	5	6
TONS CAPACITY	32	45	60

Flywheel or geared type. Drive can be mounted on either side. MINSTER patented Combination Air Friction Clutch and Brake Unit mounted within flywheel or drive gear on crankshaft.



HEAVIER FRAME FOR GREATER RIGIDITY, ACCURACY AND DIE LIFE

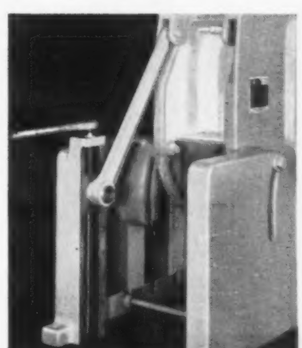
Frame closed in on top and front completely encloses bearing caps, thus providing better distribution of work forces. Connection cover keeps press cleaner—no oil drops hit operator.



GREATER CONNECTION STRENGTH — IMPROVED KNOCKOUT

Tail stock type connection screw locking. Increased connection strength and screw support.

T-Slotted Knockout blocks moving against frame surface give more positive knockout, are easier to adjust. No more bracket breakage.



FASTER, EASIER INCLINING

Inclining the press takes less time and labor with ratchet-wrench-operated mechanism located in press leg *at normal working height.* Die changes are made quickly in vertical position with greater safety, more accurate alignment and less die change-over time.

THE MINSTER MACHINE COMPANY • MINSTER, OHIO

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., Morton Grove, Ill.

ABRASIVES, Discs
Carborundum Co., Niagara Falls, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Michigan
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., Morton Grove, Ill.
Macklin Co., Jackson, Michigan
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
Watson-Stillman Co., Roselle, N. J.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.
General Electric Co., Schenectady, N. Y.
Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
South Bend Lathe Wks., South Bend 22, Ind.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

ARC WELDERS—See Welding Equipment, Arc

ASSEMBLING MACHINES
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.

AUTOMATIC SCREW MACHINES—See Screw Machines, Single- and Multiple-Spindle Automatic

AUTOMATION EQUIPMENT
Wilson Automation, P.O. Box 3855, Detroit 5, Mich.

BABBITT
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BALANCING EQUIPMENT
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALL-MAKING MACHINES
New Departure Div., Bristol, Conn.

BALLS
Haynes Stellite Co., Kokomo, Ind.

BAR MACHINES—See Screw Machines, Single- and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous
American Crucible Prod. Co., Port Huron, Mich.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Mueller Brass Co., Port Huron, Mich.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BAR STOCK AND SHAFTING, Steel
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Cumberland Steel Co., Cumberland, Md.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARING PILLOW BLOCKS AND CARTRIDGES
Fafnir Bearing Co., New Britain, Conn.

For more information fill in page number on Inquiry Card, on page 223

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
New Departure Div., Bristol, Conn.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.

BEARINGS, Bronze and Special Alloy
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

BEARINGS, Needle
Orange Roller Bearing Co., Inc., Orange, N. J.

BEARINGS, Oilless
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Centrifugally Cast Products Div., Shenango Furnace Co., Dover, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffman Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearing Co., Inc., Syracuse, N. Y.
Timken Roller Bearing Co., Canton, Ohio.

BELT SANDERS—See Grinding Machines, Abrasive Belt

BENCH CENTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENCHES AND STOOLS
South Bend Lathe Works, South Bend 22, Ind.

BENDERS, Bar, Tube, Channel, etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

BENDERS, Cleat
Smith, R. E., Waukegan, Ill.

BENDERS, Plate, Etc.
Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7412 S. Loomis Blvd., Chicago 36, Ill.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

BENDING MACHINES, Hydraulic
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., Roselle, N. J.

BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.
Watson-Stillman Co., Roselle, N. J.

BENDING ROLLS
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

BLAST CLEANING EQUIPMENT
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Pangborn Corp., Hagerstown, Md.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

BLUING LAYOUT
Dykem Co., 2307 N. 11th St., St. Louis 6, Mo

BLUEPRINT MACHINERY & ACCESSORIES
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

BOLTS, NUTS AND SCREWS
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Ottemiller, W. H., & Co., York, Pa.
Parker-Kalon Div., Clifton, N. J.
Russell Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.

BORING BARS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.

(*Continued on page 262*)

For more information fill in page number on Inquiry Card, on page 223

Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING HEADS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lovejoy Tool Co., Inc., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BORING MACHINES

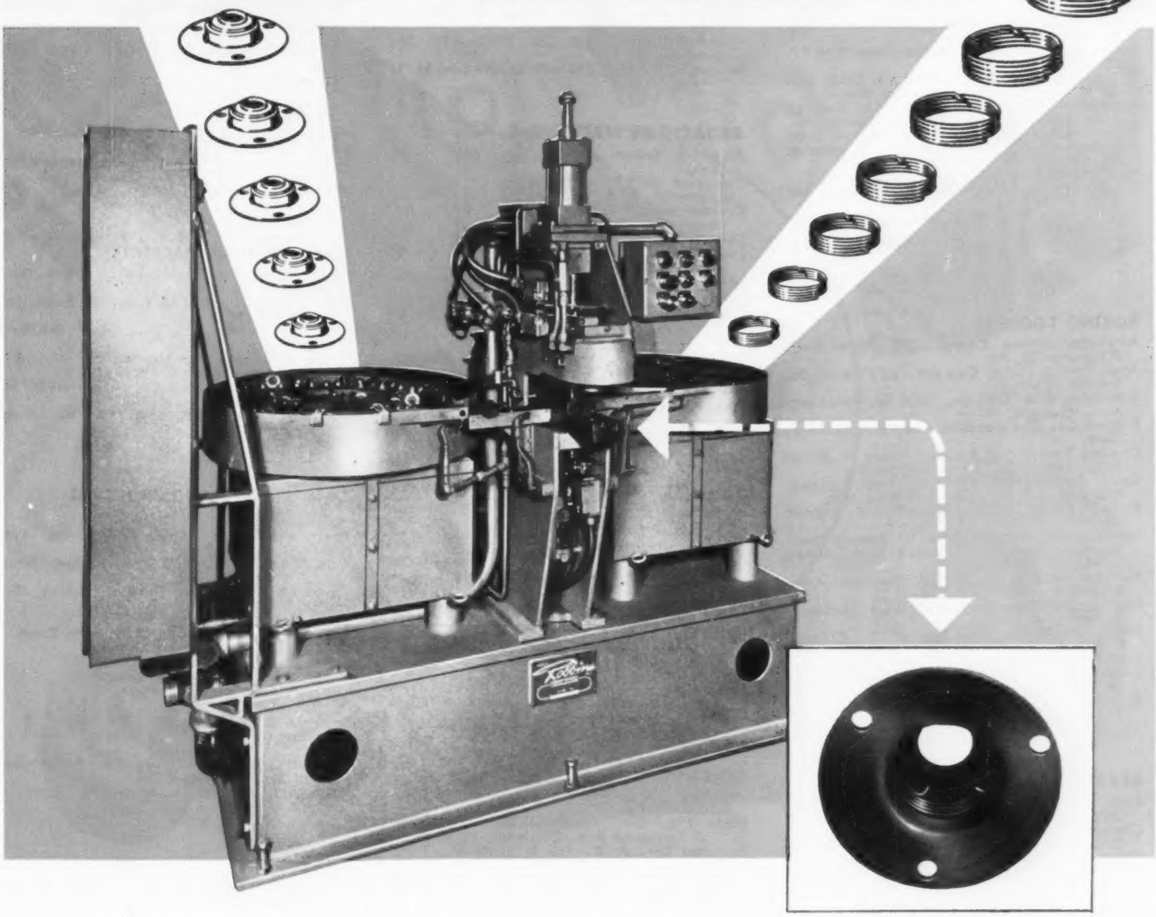
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., Bridgeport 6, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Canton Tool Mfg. Co., E. Canton, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pope Machinery Co., Haverhill, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette St., Detroit 9, Mich.
Wadell Equipment Co., Clark, N. J.
Wales-Strippit Co., Akron, N. Y.

BORING MILLS, Horizontal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Innocenti, Milan, Italy.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

FEEDS, POSITIONS, ASSEMBLES, UNLOADS

AUTOMATICALLY



1,440 INTRICATE SPRING-STAMPING ASSEMBLIES PRODUCED EVERY HOUR!

An automatic machine that installs *coil springs?* Right! . . . it's the new Robbins "Assemblimatic" Twin Feed Special. Two parts, a spring and stamped housing for an automotive window regulator, are hopper-fed into a hat-shaped track . . . housing open side up. The spring is fed over it, compressed and pressed into place. A second ram holds the spring . . . the housing is rotated until spring end is properly located in relation to housing holes . . . the finished assembly is unloaded, *at the rate of 1,440 assemblies per hour at 90% efficiency.*

In addition to completely automatic operation the machine features: electronic production control; automatic lubrication; hardened and ground ways; electrical and pneumatic equipment to J.I.C. standards, and *compactness* . . . the machine measures 82″ wide x 38″ deep x 70″ high and weighs less than 5,000 pounds.

Robbins "Assemblimatic" Machines are, *in fact*, the right answer to a wide range of assembly problems. They have cut manpower requirements, increased production, improved quality, reduced scrap in many mass production operations . . . and, chances are they can do the same for you. Find out now! Call in a Robbins special assembly machine engineer today, or send part prints for detailed recommendations.

New brochure describes and illustrates a variety of Robbins special assembly machines. Write for your copy today.

We offer complete facilities and qualified personnel to undertake special development projects.

OMER E. ROBBINS COMPANY
24802 PLYMOUTH ROAD • DETROIT 39, MICH.

Robbins

SPECIAL MACHINES

For more information fill in page number on Inquiry Card, on page 223

BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
New Britain Mch. Co., New Britain, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

BORING TOOLS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Apex Tool & Cutter Co., Inc., 285 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Sq., Pittsburgh 22, Pa.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park, Annex Detroit 32, Mich.
Portage Machine Co., 1025 Sweitzer Ave., Akron 11, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio.
Cincinnati Shaper Co., Hopple & Gerrard, Cincinnati, Ohio
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Dreis & Krump Mfg. Co., 7412 S. Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
duMont Corp., Greenfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BROACHING MACHINE, Internal

American Broach & Mch. Co., Ann Arbor, Mich.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface

American Broach & Mch. Co., Ann Arbor, Mich.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati, Ohio.
Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Detroit Broach Co., Rochester, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Mueller Brass Co., Port Huron 35, Mich.

BRUSHES, Industrial, Tampico, Wire Wheel, Etc.

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Pittsburgh Plate Glass Co., Brush Div., Baltimore 29, Md.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio.

BULLDOZERS, Metalforming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar Div., A. B., 142 N. Duke St., York, Pa.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

BURNISHING MACHINES

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel

Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal

American Crucible Products Co., Lorain, Ohio.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Standard Pressed Steel Co., Jenkintown, Pa.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPERS, Vernier

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

CAM MILLING AND GRINDING MACHINES

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS

Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Pa.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CASTINGS, Die

American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous

American Crucible Products Co., Lorain, Ohio.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Denver, Ohio.
Dow Chemical Co., Midland, Mich.
Mueller Brass Co., Port Huron 35, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS, Gray Iron, Malleable

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Centrifugally Cast Products Div.—Shenango Furnace Co., Dover, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

40 STYLES—OVER 200 TOOLS—

MAKE KENDEX* TOOLING ADAPTABLE

for virtually every machining job

The production-boosting, cost-cutting, job-simplifying advantages offered by the Kendex throw-away, turn-over insert principle can be adapted to practically any machining job.

Over 40 styles and over 200 Kendex tools let you make savings in boring; profiling; chamfering; odd job, step and face milling . . . on older machines as well as on the newer automatic cycling types.

Kendex tools permit quick changing of inserts without resetting the tool, eliminate costly insert and chip-breaker grinding, give better chip control, permit use of harder grades like Kennametal K7H along with many other grades in inserts of various sizes and shapes to give best results on any specific job. Many of the tool styles offer a choice of positive or negative rake which accommodate either regular or precision ground inserts. Kendex offers the most advanced and complete line of metalworking tools available today.

The pictures above merely suggest the many tools in which the Kendex principle is available. Your Kennametal Tool Engineer will help you apply Kendex tools to your operations. He works exclusively with Kennametal tooling . . . applying and servicing it . . . working with production men in mapping the best solutions to tough machining problems. Give him a call or write KENNAMETAL INC., Latrobe, Pennsylvania.

*Trademark

C-3065

MINING, METAL AND WOODWORKING TOOLS

WEAR AND HEAT-RESISTANT PARTS

INDUSTRY AND KENNAMETAL

. . . Partners in Progress

ABRASION, CORROSION-RESISTANT PARTS

PERCUSSION AND IMPACT PARTS

For more information fill in page number on Inquiry Card, on page 223

CASTINGS, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Pittsburgh 22, Pa.

CEMENT, Abrasive Disc

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

CENTER-DRILLING MACHINES

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES — See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe

Houston Grinding & Mfg. Co., Inc., Houston 8, Texas
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Scully Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

CHUCKING MACHINES, Single-Spindle Automatic

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter and Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

CHUCKS, Air Operated

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cushman Chuck Co., 800 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mech. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Combination Universal-Independent

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating

Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm

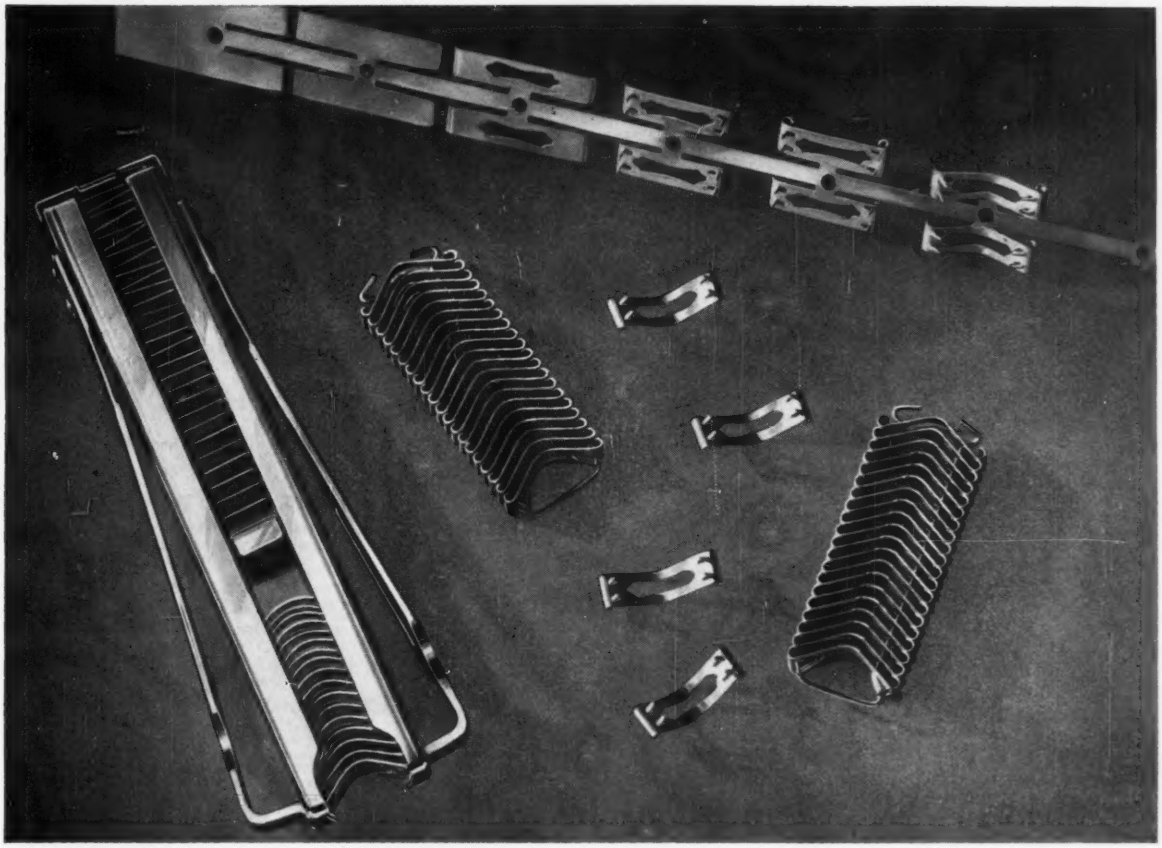
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Wadell Equip. Co., Terminal Ave., Clark, N. J.

CHUCKS, Drill, Key Type

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.



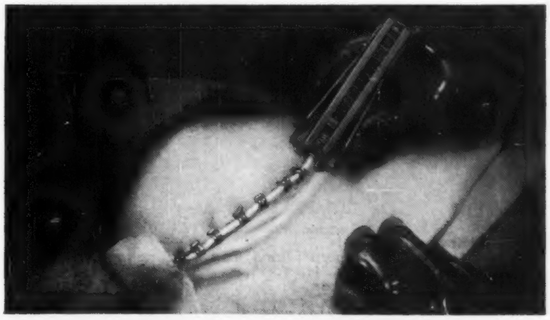
Above: The various steps in forming Autoclips® from Anaconda 18% Nickel Silver strip, .637" wide by .013" thick. Below are individual Autoclips and those mounted in wire holders ready for insertion in Autoclip Applier, at left. Exclusive wholesale distributor for Autoclip is Clay-Adams, Inc., New York City. ***Below, left:*** Autoclips being used to attach skin towel to edges of incision.

Anaconda Technical Service helped in

Selecting the exact Nickel Silver strip for this surgical clip

THE PROBLEM: The Technical Oil Tool Corporation, Los Angeles, developed Autoclip, an automatic magazine-type clip and applier to close wounds or incisions faster and easier. Selecting the right metal for the clip was the problem. A certain amount of tension was required to hold the wound edges together during healing, with the least amount of damage to tissues. In addition, the clip had to open easily for painless removal. The metal should be easy to form, and retain sharp, die-cut edges.

THE SOLUTION: After several unsuccessful attempts with various metals, sample clips of the required gage were made of Nickel Silver. These silvery white copper-alloys have excellent resistance to corrosion in service or in storage and have been time-tested for surgical instruments and equipment. Technical specialists of The American Brass Company suggested Nickel Silver, 18%-719—one of four standard Anaconda Nickel Silver Alloys—as the one best suited to meet all the requirements including tension, formability, clean edges and sharp points.



FREE TECHNICAL SERVICE: Metallurgists and technical specialists in The American Brass Company, through their day-to-day work with a great variety of metal problems, offer a tremendous breadth of experience. And this experience is at your disposal—to help you select the exact alloy, form, temper for your job. Call your American Brass Company representative, or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5769

ANACONDA®
COPPER, BRASS, BRONZE *and* NICKEL SILVER
Made by The American Brass Company

For more information fill in page number on Inquiry Card, on page 223

CHUCKS, Full Floating
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Horton Chuck, Windsor Locks, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.

CHUCKS, Independent
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Walker, O. S., Inc., Worcester, Mass.

CHUCKS, Power Operated
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Jacobs Mfg. Co., West Hartford 10, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Universal Three-Jaw
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gisholt Mch. Co., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
Horton Chuck, Windsor Locks, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CIRCUIT-BREAKERS
General Electric Co., Schenectady 5, N. Y.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment Spacing Equipment

CLEANERS, Metal
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES
Cleveland Punch & Shear Works, Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Dynamatic Div. Eaton Mfg. Co., Kenosha, Wis.
Fawick Corp., Cleveland, Ohio
Minster Mch. Co., Minster, Ohio.
Rockford Clutch Div., Rockford, Ill.

COLLETS—See Chucks, Collet

COMBINATION SQUARES—See Machinists' Small Tools

COMPARATORS, Dial, Electronic and Air
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn. (dial, thread)
Sheffield Corp., Box 893, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning—See Cleaners, Metal

COMPOUNDS, Cutting, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

For more information fill in page number on Inquiry Card, on page 223

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio.
Bliss, E. C., Co., 1375 Raff Rd., S. D., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Van Keuren Co., Watertown, Mass.

CONTROLLERS

Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.

CONTROL SHAFTS—See Lead-screws & Splines, Ball Bearing

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes, W. F. & John Co., Rockford, Ill.
Indiana Commercial Filters Corp., 28 South Ave., Lebanon, Ind.

COPPER

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

COUNTERBORES AND COUNTERSINKS

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 120 Oakman Blvd., Detroit 32, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Heller Tool Co., Newcomerstown, Ohio
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mass.

COUNTERS

Starrett, The L. S., Co., Athol, Mass.

COUPLINGS

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Philadelphia Gear Works, Erie Ave., and G Sts., Philadelphia, Pa.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa. (Shaft)
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio

CUTTERS, Keyseating

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
DoAll Co., Des Plaines, Ill.
du Mont Corp., Greenfield, Mass.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.
National Twist Drill Co., Rochester, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Goddard & Goddard Co., Detroit, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn. (dial, thread)
Haynes Stellite Co., Kokomo, Ind.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Onsrud Machine Works, Inc., Niles, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati, Ohio
Cincinnati Milling and Girnding Mchs., Inc., Cincinnati 9, Ohio
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., Des Plaines, Ill.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

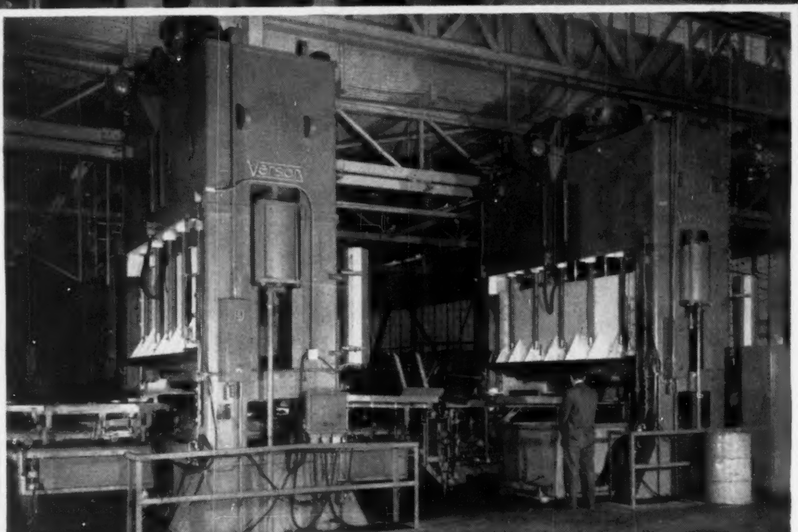
CUTTING-OFF MACHINES, Lathe Type

Bardons & Oliver, Inc., 1133 West Ninth St., Cleveland 13, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel

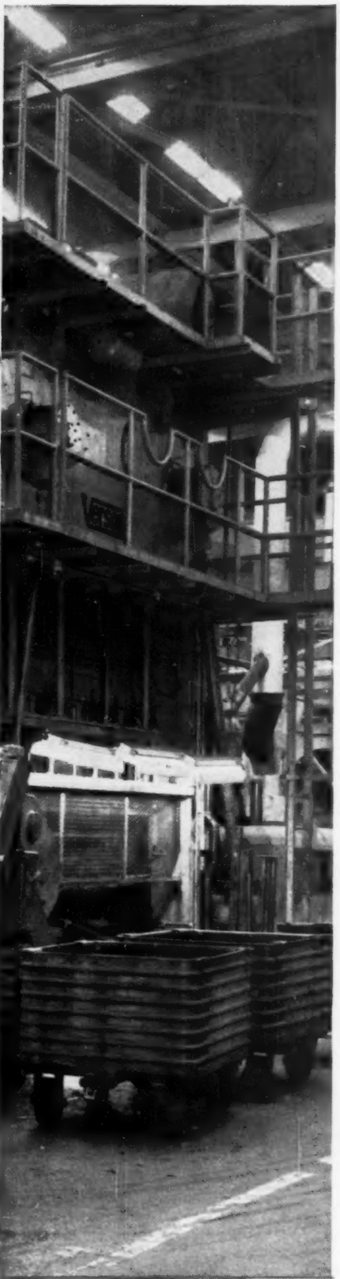
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Pa.
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

For more information fill in page number on Inquiry Card, on page 223



An automated Verson press line which incorporates two standard Verson 400 ton Eccentric Presses. Changing requirements could be met by modifying handling equipment or the presses could be used individually.

859



A good example of Transmat versatility. Each of these three identical 800 ton, 8 station Verson Transmats is capable of making any of four different automotive parts at the rate of 1000 per hour.

You can combine versatility with automatic high speed production

. . . with Verson Transmat Presses or an automated Verson press line

Verson Transmat Presses or Verson Automated Press Lines are designed first and foremost for the purpose of producing a specific multi-operation stamping in large quantities at the lowest possible cost. Any other consideration is secondary to the achievement of this objective.

However, Verson engineering has made it possible to offer surprisingly broad versatility in machines that would normally be considered single purpose. The Transmat, for example, has individually adjustable wedge slides which may be arranged for ram cushions. Adjustable stroke individual knock out cylinders are provided at each station. A variety of bed cushion arrangements is available. Provision can be made for stack or coil feed. Non-oscillating feed bars are adaptable to changing requirements. By taking advantage of these features, users have been able to make more than one part on the same Transmat.

The automated press line, since it often incorporates standard presses, is even more versatile. Handling equipment can often be modified to accommodate radical changeover.

If uncertainty about the adaptability of high production tool ups to changing requirements has kept you from taking advantage of the cost reductions they make possible, it is time to talk to Verson application engineers. They will welcome the opportunity to show you what has been done and what can be done. And remember, the Verson concept is to give you versatility without sacrificing the cost cutting advantages of high output.

A Verson Press for every job from 60 tons up.

TRADE Verson MARK

ORIGINATORS AND PIONEERS OF ALLSTEEL STAMPING PRESS CONSTRUCTION

VERSON ALLSTEEL PRESS CO.

9309 S. KENWOOD AVENUE, CHICAGO 19, ILLINOIS • 8300 S. CENTRAL EXPRESSWAY, DALLAS, TEXAS

MECHANICAL AND HYDRAULIC PRESSES AND PRESS BRAKES • TRANSMAT PRESSES
TOOLING • DIE CUSHIONS • VERSON-WHEELON HYDRAULIC PRESSES

For more information fill in page number on Inquiry Card, on page 223

CUTTING TOOLS—See Tool Material

CYLINDERS, Air

Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.
Hannifin Corp., 501 Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee Wis.
Vickers, Inc., Detroit 32, Mich.
Wilson, K. R., Inc., Arcade, N. Y.

DEBURRING MACHINES

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio
Sheffield Corp., Box 893, Dayton 1, Ohio
Wallace Supplies Mfg. Co., 1308 Diversey Parkway, Chicago 14, Ill.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge Mass.
Lufkin Rule Co., Saginaw, Mich.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 47C Woodward Ave., Buffalo 17, N. Y.

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dayton Rogers Mfg. Co., Minneapolis, Minn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Minster Mch. Co., Minster, Ohio
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.

DIEING MACHINES

Pratt & Whitney Co., Inc., West Hartford, Conn.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal Inc., Latrobe, Pa.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wales-Strippit Co., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies

DIES, Blanking, Forming, Drawing, Extruding, etc.

Bath, Cyril Co., 32324 Aurora Road, Solon, Ohio
Cincinnati Shaper Co., Hopple & Garrard, Cincinnati, Ohio
Dreis & Krump Mfg. Co., 7400 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Lettering and Embossing

Wales-Strippit Corp., North Tonawanda, N. Y.

DIES, Self-opening Threading

Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Eastern Mch. Screw Corp., New Haven, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling

Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.

DISINTEGRATORS

Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Electro-Spark Co., Inc., 23 E. 26th St., New York 10, N. Y.
Elox Corp., Royal Oak 3, Mich.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
DoAll Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAWING COMPOUNDS

Oakite Products, Inc., 26 Rector St., New York 6
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.

DRESSERS, Grinding Wheel

Colonial Broach & Machine Co., P. O. Box 37, Harper St., Detroit 13, Mich.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hoglund Eng. & Mfg. Co., Inc., Berkeley Hts., N. J.
Metal Carbides Corp., Youngstown, Ohio
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

DRIFT KEYS

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buffalo Forge Co., Broadway, Buffalo, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.

(Continued on page 278)

Improve Monday morning efficiency—switch to STUART SOLUBLE OILS with guaranteed longer service life!

Anaerobic bacteria (present in practically all machine shops) thrive in your water-mix cutting and grinding fluids and generate that expensive perfume known as "Monday Morning Odor." Expensive because it's a sure sign the stability of the compound is being damaged—service life shortened—and because your workers' efficiency is bound to suffer.

So regardless of your experience with other bactericides, it will pay you to try Stuart's heavy-duty soluble cutting and grinding compounds with the anaerobic bacteria inhibitor that's *guaranteed* to keep the emulsion stable and sweet three to four times longer than other water mixtures . . . even in hot weather and through long shutdowns when bacteria multiply fast.

LONGER SERVICE LIFE GUARANTEED

Talk the problem over with your Stuart engineer and place a trial order for Solvol "X," Codol "X," Dasco Super Soluble "X" Base, or new general-purpose Dasco D-20—whichever of these top-quality, heavy-duty cutting and grinding compounds best fits your needs. D. A. Stuart Oil Co., Limited *guarantees your complete satisfaction* with the bacteria resistance of these compounds, on a money-back basis! Phone your Stuart Service Center . . . before "Monday Morning Odor" hits your plant for another efficiency loss.

SOLVOL "X" • DASCO D-20 • CODOL "X"
DASCO SUPER SOLUBLE "X" BASE

Phone your Stuart Service Center

Arrange now to test Stuart's water-mix cutting and grinding fluids on your difficult machining jobs.

DETROIT, MICH.	Tyler 7-8500
CHICAGO, ILL.	Bishop 7-7100
HARTFORD, CONN.	Jackson 7-1144
CLEVELAND, OHIO	Prospect 1-7411
PHILADELPHIA, PA.	Devonshire 8-6100
TORONTO, CANADA	Oxford 9-9397

Representatives in all principal cities

SINCE 1865

D. A. STUART OIL CO., LIMITED
2727 South Troy Street, Chicago 23, Illinois
CANADIAN D. A. STUART OIL CO., LIMITED
3575 Danforth Avenue, Toronto 13, Ontario

Stuart

METALWORKING LUBRICANTS

For more information fill in page number on Inquiry Card, on page 223

Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Millholland, W. K. Machinery Co., 6403 Westfield Blvd., Indianapolis 5, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kiswaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Illinois

DRILL SLEEVES AND EXTENSION HOLDERS

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Richmond, Ind.
National Twist & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.

DRILLING AND BORING UNITS, Self-contained

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Govro-Nelson Co., 1831 Antoinette St., Detroit 8, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Homestrand, Inc., Larchmont, N. Y.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., Milwaukee 14, Wis.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit, Mich.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Automatic

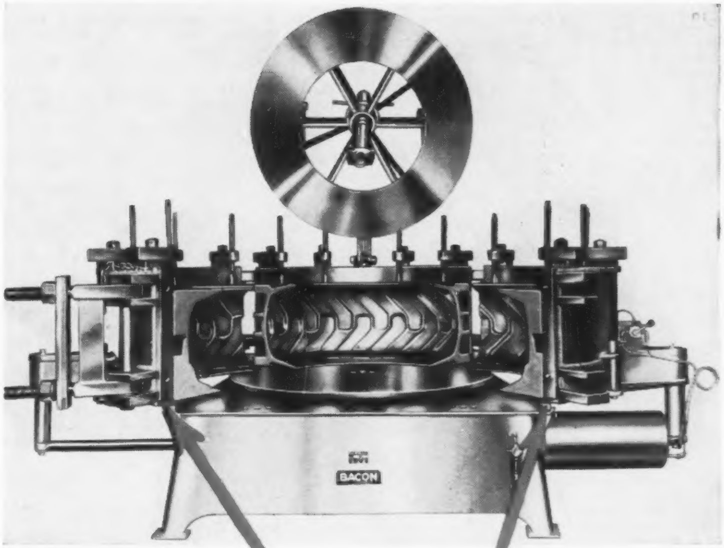
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Edlund Mchry. Co. Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Dr., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Bench

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co. 2,5 East Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

(Continued on page 280)

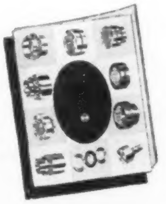
Bacon All-Purpose Tire Molds feature an exclusive "squeeze" principle through air-actuated mechanisms, which provide perfect treads without distortion on all sizes of tires from motorcycle to largest 18:00-24 truck tires. All hinges are mounted on Orange Roller Bushings to eliminate friction and assure smooth operation while opening and closing.



ORANGE
ROLLER BUSHINGS
meet a "Tight Squeeze" in Load and Space

Orange Roller Bushings are available in stock sizes from ½" to 8" shaft dia., fully interchangeable with all standard heavy-duty needle bearings. Stocks and engineering service in all principal industrial areas.

WRITE for free 40-page Engineering Reference Manual M-56 giving details of construction, dimensions, capacities, etc., on complete line of Orange Roller Bearings.



In addition to meeting load requirements, engineers at Bacon Vulcanizer Manufacturing Company put a "tight squeeze" on space requirements due to the high-load, small-space advantages of Orange Roller Bushings.

Orange Roller Bushings are full-type needle bearings built for heavy-duty service. Rollers and races are made of finest bearing steel—hardened, ground and finished to highest precision standards. Roller uniformity is controlled by electronic gauging, permits closer internal running clearances, minimizes possibility of misaligned rollers.

Wherever a shaft or part rotates or oscillates, Orange Roller Bushings offer great opportunity to fight friction and wear, save space, eliminate trouble spots and improve performance.

ORANGE ROLLER BEARINGS

ORANGE ROLLER BEARING CO., Inc.
552 Main Street, Orange, N. J.

Needle Bearings — Staggered Roller Bearings
Journal Roller Bearings — Thrust Roller Bearings
Cam Followers

ORANGE

For more information fill in page number on Inquiry Card, on page 223

Delta Power Tool Div., 400 N. Lexington Ave., Pittsbugh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Henry & Wright Div., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Deep Hole

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit Corp., Akron, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cleereman Machine Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Henry & Wright Div., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., Moline, Ill.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, South Bend 22, Ind.
Western Machine Tool Works, Holland, Mich

DRILLING MACHINES, Radial

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Morris Machine Tool Co., Inc., 933 Harriet St., Cincinnati 3, Ohio
Onsrud Machine Works, Inc., Niles, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLING MACHINES, Sensitive

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co., Inc., Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Edlund Machinery Co. Div., Cortland, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio
Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Henry & Wright Div., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
Levin & Son, Inc., Louis, 3610 So. Broadway, Los Angeles, Calif.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Townsend, H. P., Mfg. Co., Elmwood, Conn.
Wales-Strippit Corp., Akron, N. Y.
Western Machine Tool Works, Holland, Mich.

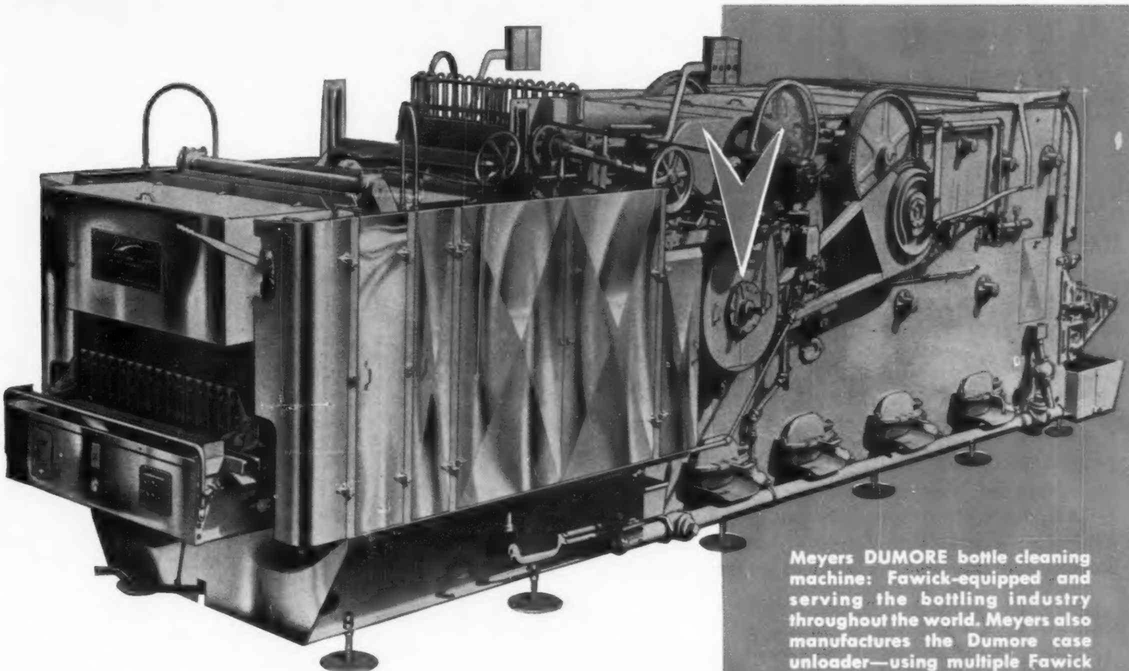
DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Avey Drilling Machine Co., 25 East Third St., Covington, Ky.
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Canton Tool Mfg. Co., E. Canton, Ohio.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio
Cincinnati Lathe & Tool Co., Marburg Ave., Cincinnati 9, Ohio
Cleereman Machine Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.

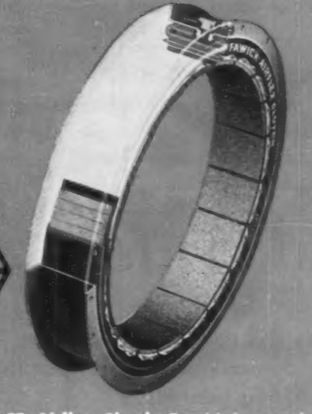
(Continued on page 282)



Meyers DUMORE bottle cleaning machine: Fawick-equipped and serving the bottling industry throughout the world. Meyers also manufactures the Dumore case unloader—using multiple Fawick Clutches and Brakes.

this world-wide supplier of bottling equipment reports—

"our customers *specify* Fawick Airflex Clutches"



CB Airflex Clutch: For high speed cyclic or continuous operation . . . needs no lubrication . . . adjusts automatically for wear of friction shoes.

"Fawick . . . has eliminated many years of difficulties experienced with mechanical clutches."

". . . now we have no adjustments for proper operation . . . bulky and troublesome linkages are eliminated."

". . . our customers are specifying that our new machinery be equipped with Fawick Airflex Clutches."

—George J. Meyer Manufacturing Co., Cudahy, Wisc. Largest firm in the world devoted exclusively to manufacture of bottling equipment.

Airflex Clutches and Brakes are eliminating maintenance—providing increased production, greater safety and fast, fingertip control on *every type* of power equipment.

Discover the important, profit-boosting reasons for FAWICK leadership in *making power behave.*

FAWICK AIRFLEX DIVISION
FAWICK CORPORATION
9919 CLINTON ROAD • CLEVELAND 11, OHIO
In Canada: Fawick Canada Ltd., Toronto

Performance is Proof . . . Fawick is Best

FAWICK *Airflex*

INDUSTRIAL CLUTCHES AND BRAKES

For more information fill in page number on Inquiry Card, on page 223

Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N. St., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Wales-Strippit Corp., Akron, N. Y.
Western Machine Tool Works, Holland, Mich.

DRILLS, Center

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Ace Drill Corp., Adrian, Mich.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Twist Drill & Tl. Co., Rochester, Mich.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Deep Hole, Gun

Ace Drill Corp., Adrian, Mich.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Oil Hole, Oil Tube

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tl. Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

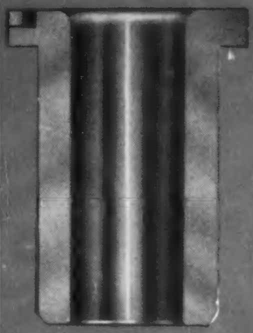
DRILLS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Onsrud Machine Works, Inc., Niles, Ill.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

for accuracy in your production
it pays to specify

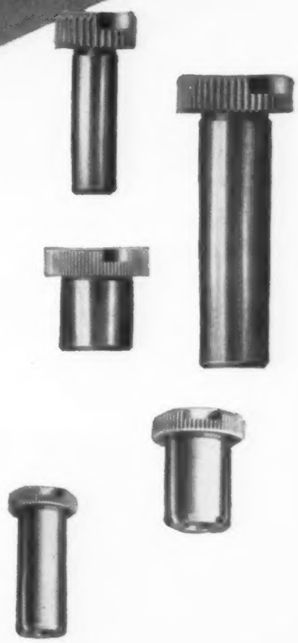
UNIVERSAL DRILL BUSHINGS

In Universal you get the best. Machined from finest quality steel. Blended radius on the top-inside diameter helps prevent tool hang-up and breakage. 100% concentricity and hardness tests insure accuracy and uniform quality. Knurled heads provide a quick, sure grip.

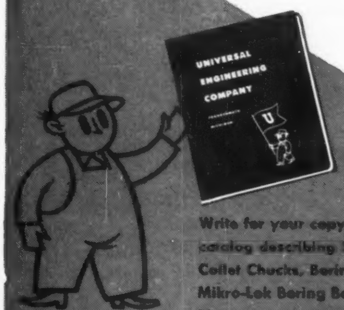


superfinish bores lengthen tool life

The superfinishing of Universal Drill Bushings is an important factor in keeping tool and bushing wear to a minimum—especially in close tolerance work.



Standard sizes and lengths in stock for immediate delivery. Contact the office nearest you—Universal Engineering Sales Co., 1060 Broad St., Newark 2, N. J.; 5035 Sixth Ave., Kenosha, Wis.—or our home office.



Write for your copy of our new 98 page catalog describing Standard Collet Chucks, Floating Collet Chucks, Boring Chucks, "Kwik-Switch" Tool Holders, Mikro-Lok Boring Bars, Standard Drill Bushings, Universal Index Plungers and other Universal products.

UNIVERSAL ENGINEERING COMPANY | FRANKENMUTH 2, MICHIGAN

For more information fill in page number on Inquiry Card, on page 223

DRILLS, Rachet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Subland

Ace Drill Corp. Adrian, Mich.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd. Plymouth, Mich.

DRILLS, Twist, High-Speed Steel, Carbon Steel

Ace Drill Corp., Adrian, Mich.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist, Carbide, Carbide-tipped

Ace Drill Corp., Adrian, Mich.
Allegheny Ludlium Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
DoAll Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Pa.
National Twist Drill & Tool Co., Rochester, Mich.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Ace Drill Corp., Adrian, Michigan
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., Cleveland, O.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

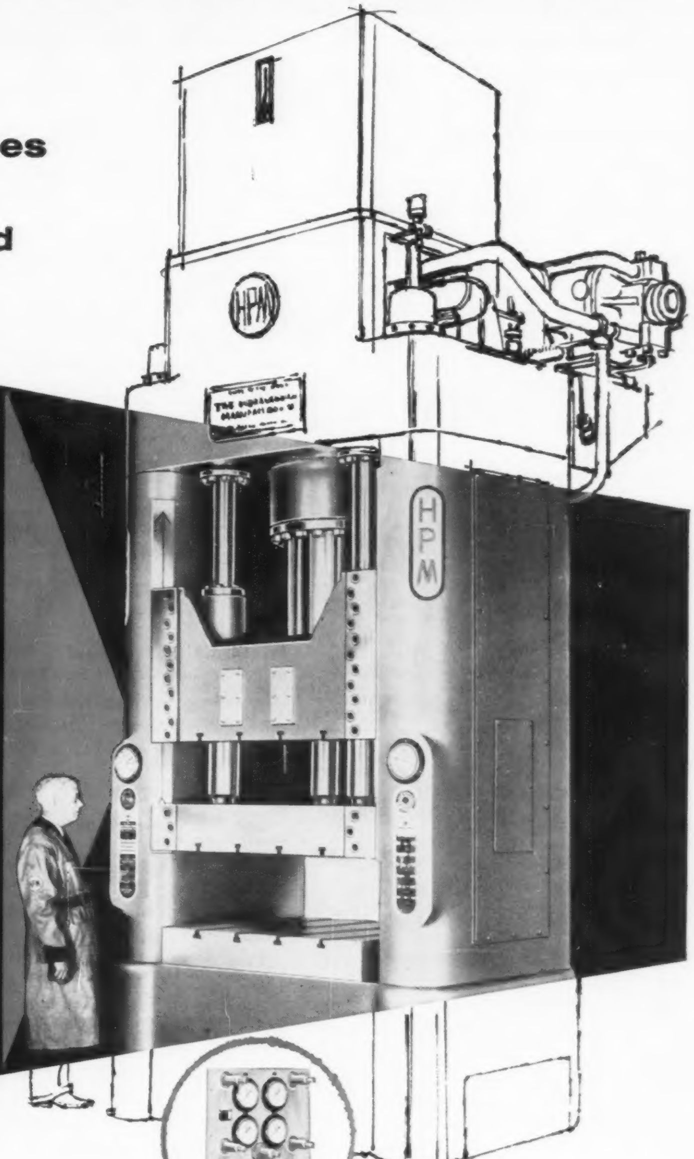
DUPLICATING ATTACHMENTS — See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS

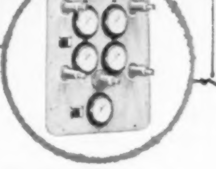
Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio

here's why H-P-Ms PAY OFF

H-P-M 3-in-1 Blankholder Presses Give You More Per Dollar Invested



- HIGH SPEED PRODUCTION—Famous H-P-M Closed-Circuit Operating System.
- LOW MAINTENANCE COST—One Pump Operating System.
- FAST SET-UP—All Controls for Blankholder, Die Cushion and Main Ram Pressures At Operator's Fingertips.
- INDEPENDENT GUIDE ADJUSTMENT—Slide Above Slide Tandem Ram and Blankholder Guides.



All pressure controls conveniently close to operator's work station.

For Single Action Jobs

blankholder locks to face of main slide. Only main ram operates. Die cushion is idle.

For Deep Drawing Jobs

blankholder is locked to face of main slide. Main ram and die cushion operate. Die cushion used as lift-out with delayed action on return stroke.

For Deep Drawing Jobs

main ram, blankholder and die cushion operating. The latter serves as lift-out with delayed action on return stroke.

And, With H-P-M

pressure resistance of each blankholder ram can be individually adjusted—invaluable when drawing parts of irregular contours where blank must be held more firmly at certain points than others.

For complete information, write for Bulletin 5600.

HPM

THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.
A DIVISION OF KOEHRING COMPANY

ELECTRICAL DISCHARGE MACHINES
—See Disintegrators

ELECTROPLATING EQUIPMENT
Wagner Brothers, Inc., 433 Midland Ave., Detroit 3, Mich.

ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

EXPANDERS, Mechanical, Hydraulic
Grotnes Machine Wks., Inc., 5454 N. Walcott, Chicago 40, Illinois

EXTRACTORS, Screw
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Greenfield Tap & Die Corp., Greenfield, Mass.
Walton Co., Hartford 10, Conn.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div. Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FEEDERS, Automatic
Perry Equipment & Eng. Co., Erie, Penna.
V & O Press Co., Hudson, New York

FILES, Band
DoALL Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
DoALL Co., Des Plaines, Ill.
Heller Tool Co., Newcomerstown, Ohio
Pratt & Whitney Co., Inc., West Hartford, Conn.
Severance Tool Ind., Inc., Saginaw, Mich.
Simonds Saw & Steel Co., Fitchburg, Mass.
Wesson Co., 1220 Woodward Heights Blvd. Ferndale, Mich.

FILING MACHINES
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoALL Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Coolant and Oil
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Commercial Filters Corp., Lebanon, Ind.
Industrial Filtration Co., 15 Industrial Ave., Lebanon, Ind.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

FINISHES, Machine and Metal
Lowe Bros. Co., Dayton, Ohio

FLAME-HARDENING MACHINES
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

FORGING HAMMERS, Steam and Air
Chambersburg Engrg. Co., Chambersburg, Pa.

FORGING MACHINES, Headers, Upsetters, Presses
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
National Machinery Co., Tiffin, Ohio

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.
Wyman-Gordon Co., Worcester, Mass.

FORGINGS, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron, Mich.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
U. S. Steel Corp., Pittsburgh, Pa.
Wyman-Gordon Co., Worcester, Mass.

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
New Departure Div., Bristol, Conn.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORMING MACHINES, Cold-rolling
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North Main St., Ampere, N. J.

FORMING TOOLS or Tool Blanks
Brown & Sharpe Mfg. Co., Providence, R. I.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

GAGES, Automatic Sorting
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Electric Comparator
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
General Electric Co., Schenectady, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.

GAGES, Grinding
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper, Telescoping Thickness
Brown & Sharpe Mfg. Co., Providence, R. I.

GAGES, Multiple Inspection
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Plug and Ring
Brown & Sharpe Mfg. Co., Providence, R. I.
Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.
DoAll Co., Des Plaines, Ill.

(Continued on page 288)

Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Pressure, Air and Hydraulic

Modern Industrial Eng. Co., 14230 Birwood Ave., Detroit 38, Mich.

GAGES, Roll Thread Snap, Adjustable Snap

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Size Control Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

GAGES, Surface Roughness

DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett Co., L. S., Athol, Mass.

GASKETS

Garlock Packing Co., Palmyra, N. Y.

GEAR BURNISHERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHAMFERING, ROUNDING AND DEBURRING MACHINES

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GEAR CHECKING EQUIPMENT

Brown & Sharpe Mfg. Co., Providence, R. I.
Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR CUTTING MACHINES Bevel and Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEAR GRINDERS—See Grinding Machines, Gear

GEAR HOBBERS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

GEAR HONERS

National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.

A NEW AID FOR COST-CONSCIOUS MANAGEMENT

You can now determine just how much productivity you are losing because one or more elements of the operating cycle of an automated machine are not perfectly timed.

Now you can spot any timing error to within a 60th of a second immediately.

Cycle Analysis

Sheffield's new Monitorecord* system analyzes timing by means of a printed, composite time graph. This shows every start, dwell and stop of each interrelated event in the complex machine cycle – just as it occurs.

Corrective Adjustment

When a Coded Master is laid over the time graph you see just what adjustments are needed and the amount of each. No tedious groping – no costly down-time.

What could serve Preventive Maintenance more effectively than taking such a graph every day? What could save as much set-up time? This system often justifies its cost the first time it is used.

System installation is no problem. It can be applied to machines now in service or it may be built into new machines.

The readily portable Monitorecord is merely plugged into the system receptacle of any machine requiring cycle analysis. It can be moved about at will.

Get all the facts on this profit-conserving idea. Write to the *Sheffield Corporation, Dayton 1, Ohio, U.S.A., Dept. 9*

*Trademark 7828

NEW PHONE—LIncoln 5577

the SHEFFIELD corporation

manufacture and measurement for mankind

SUBSIDIARY, BENDIX AVIATION CORPORATION

GEAR LAPPERS

Fellows Gear Shaper Co., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean, Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

GEAR MOTORS—See Speed Reducers

GEAR RACKS

Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

GEAR SHAPERS

Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.

GEAR SHAVERS

Fellows Gear Shaper Co., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

GEARS, AND GEAR BLANKS, Non-metallic

Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Illinois Gear & Mch. Co., 2108 No. Natchez Ave., Chicago 35, Ill.
New Jersey Gear & Mfg. Co., Hillside, N. J.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

GEARS, Cut

Automotive Gear Works, Inc., South 8th & O St., Richmond, Ind.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Fairfield Mfg. Co., 2309 S. Earl Ave., Lafayette, Ind.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
Illinois Gear & Mch. Co., 2100 No. Natchez Ave., Chicago 35, Ill.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
New Jersey Gear Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Perkins Machine & Gear Co., W. Springfield, Mass.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch Co., 3901 Hamilton Ave., Cleveland 14, Ohio
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

GENERATORS, Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Reliance Electric & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

GRADUATING MACHINES

Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.

GREASES—See Lubricating Oils and Greases

GRINDERS, Bench, Floor and Snag

Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Jones & Lamson Mch. Co., Springfield, Vt.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
South Bend Lathe Works, South Bend 22, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
U. S. Burke Machine Tool Div., Brotherton Rd., Cincinnati 27, Ohio

GRINDERS, Carbide Tool

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.


Ross Skyline
Silvermodel
JIC Spool Solenoid
Any Skyline Head Attaches to Any Skyline Valve Body
Interchangeable! 25 Million Cycles in Tests!
Now the JIC spool solenoid valves join the Ross Skyline. Now six actuating heads and seven in-line and base mounted bodies—all completely interchangeable—give you any valve you want in this series designed especially to last millions more cycles than ordinary valves. But, these quality valves come to you at *sensible* prices! For instance, the 3/8" Silvermodel base mounted, 4-way is only $62.50 complete, and complies with all JIC requirements. Write for bulletin 315.
Ross OPERATING VALVE COMPANY
110 EAST GOLDEN GATE AVENUE • DETROIT 3, MICHIGAN

For more information fill in page number on Inquiry Card, on page 223

GRINDERS, Die and Mold

Norton Co., 1 New Bond St., Worcester 6, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

GRINDERS, Face Mill

Kearney & Trecker Corp., Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

GRINDERS, Knife and Shear

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Portable Electric

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2488-90 River, Cincinnati 4, Ohio
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

GRINDERS, Portable Pneumatic

Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

GRINDERS, Tap

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Rockford Die & Tool Wks., Inc., Rockford, Ill.

GRINDERS, Tool and Cutter

Atlas Press Co., 20108 N. Pitcher, Kalamazoo, Mich.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
Elox Corp. of Mich., Royal Oak 3, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
South Bend Lathe Wks., South Bend 22, Ind.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

For more information fill in page number on Inquiry Card, on page 223


HEAVY DUTY
MACHINE TOOLS
Horizontal, vertical lathes, facing lathes and roll lathes.
Roll grinding machines
Planing machines, milling planers
Hydraulic and power presses
Sheet straightening machines
Rolling mills for steel and soft metals
Desiging and manufacture of special heavy duty machines
EUSTACCHIO
SE
DOUBLE COLUMN VERTICAL TURNING AND BORING MILL
Turnable diameter 17'
Machining of a yankee roll shell
STABILIMENTI
S. EUSTACCHIO
S. p. A.
BRESCIA
(Italia)

GRINDERS, Toolpost

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

GRINDING MACHINES, Abrasive Belt

Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

GRINDING MACHINES, Broach

Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Lapointe Mch. Tool Co., 34 Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

GRINDING MACHINES, Cam

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Centerless

Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Landis Tool Co., Waynesboro, Pa.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Crankshaft

Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Cylindrical

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S. W., Grand Rapids 2, Mich.
Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
Van Norman Co., 2640 Main St., Springfield 7, Mass.

GRINDING MACHINES, Disc

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tools Div., 400 Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lees-Bradner Co., Cleveland, Ohio
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Internal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Van Norman Mch. Co., Springfield, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

GRINDING MACHINES, Jig

Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

GRINDING MACHINES, Profile

Baker Brothers, Inc., 1000 Post St., Toledo 10, Ohio
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Roll

Landis Tool Co., Waynesboro, Pa.

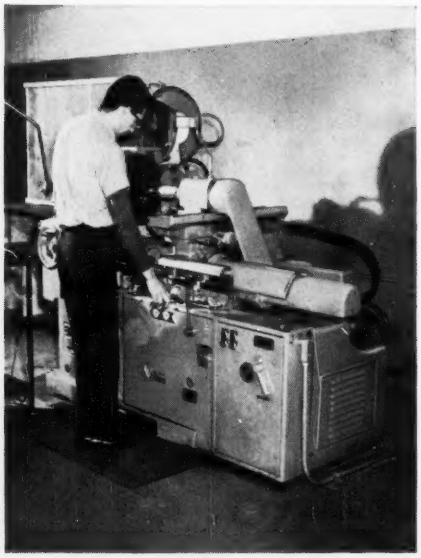
GRINDING MACHINES, Surface Reciprocating

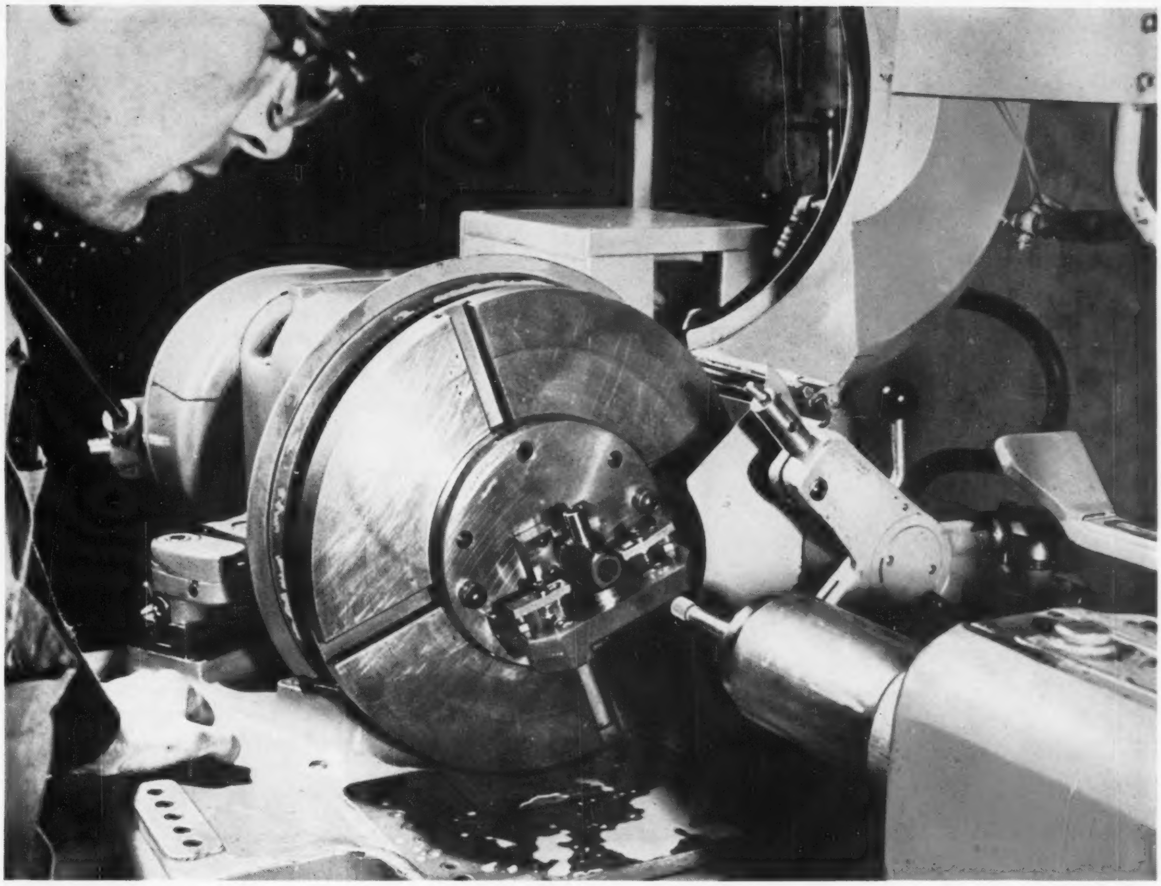
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Delta Power Tool Div., 400 Lexington Ave., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
Elox Corp. of Mich., Royal Oak 3, Mich.
Foote-Burt Co., 13000 St. Clair Ave., Cleveland 8, Ohio
Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Homestrand, Inc., Larchmont, N. Y.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.

GRINDING MACHINES, Surface Rotary

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass. (Rotary)

(Continued on page 300)





"Everything they claimed and then some..."

That's Mr. Gerald H. Buchholz talking. He's owner and manager of the Federal Tool and Instrument Company, Corona, New York, and he's talking about his No. 1116 Bryant Internal Grinder.

For more than two years now, Federal has been turning out close-tolerance work with a Bryant Grinder. Mr. Buchholz leaves no doubt as to its value: "It saves us both time and labor, and it holds tolerances better than any similar machine.

"Before our purchase of the 1116 we used an attachment on another machine for our fine work. But it was too slow for our production. We got the Bryant with an eye toward new business — and we got it!

"This machine has been everything the Bryant people claimed and then some. A man can ask no more than that."

See for yourself how a Bryant Internal Grinder can do better grinding *faster*. Ask for an immediate demonstration!

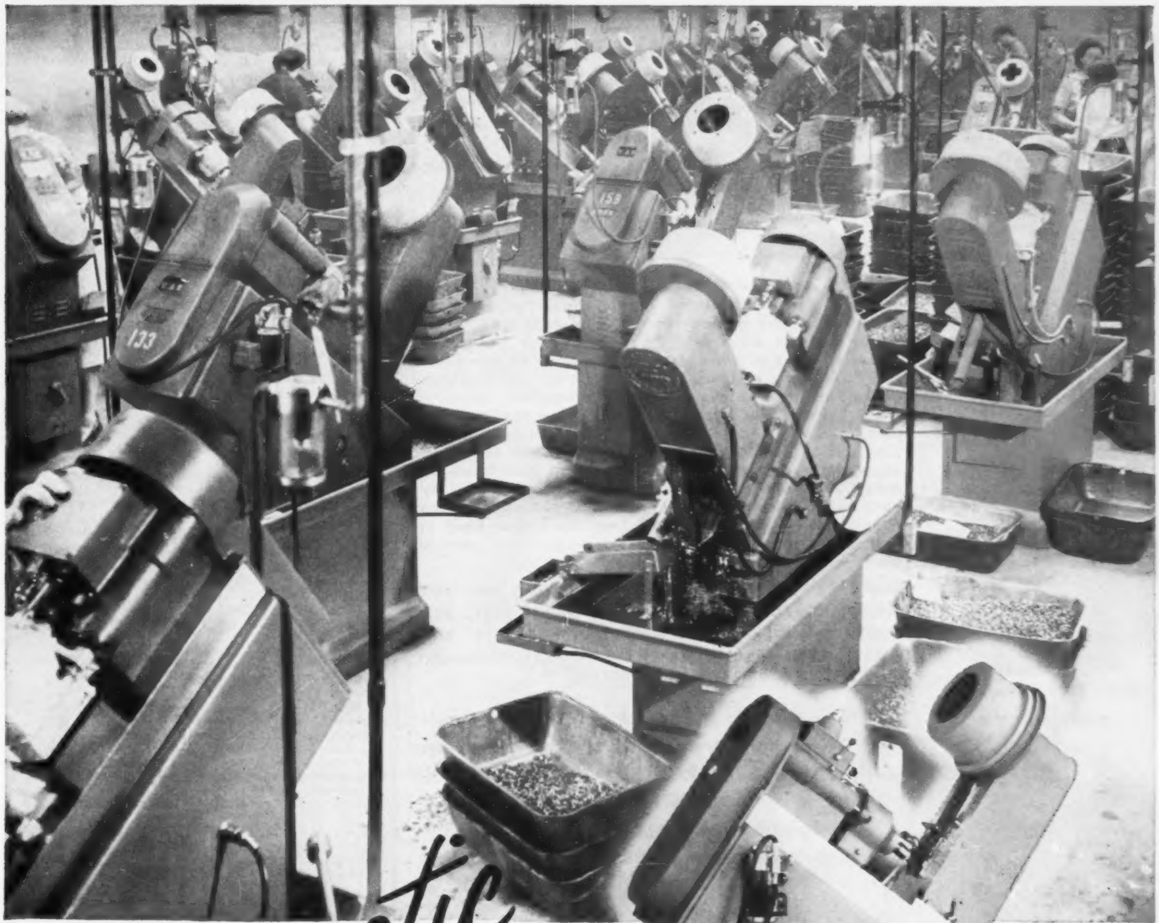
BRYANT Chucking Grinder Co.

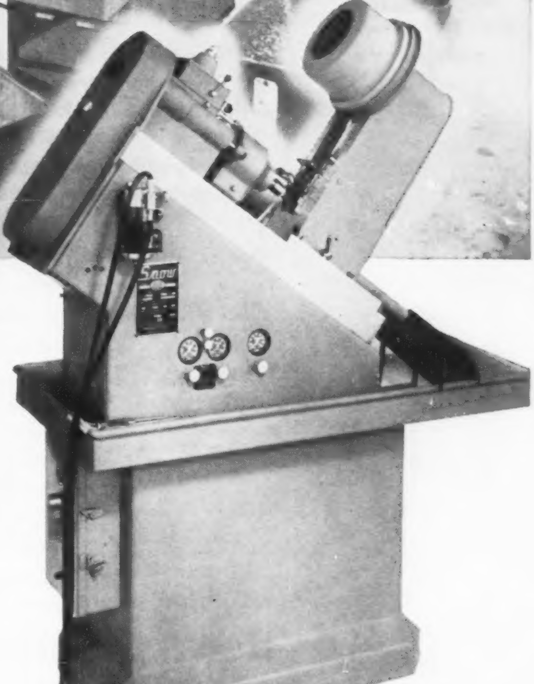
20 CLINTON STREET, SPRINGFIELD, VERMONT

Offices: Indianapolis • Cleveland • Chicago • Detroit • Mt. Vernon, N. Y. • Philadelphia

Internal Grinders • Internal & External Thread Gages • Granite Surface Plates • Magnetic Drums for Computers • Special Machinery

For more information fill in page number on Inquiry Card, on page 223





Automatic NUT TAPPING MACHINES

This installation *at Shakeproof, Division of Illinois Tool Works, Elgin, Illinois,* is an illustration of productivity—*with precision.*

Simplicity of set-up and lower operational costs can make your Nut Tapping Department one of the most efficient and profitable in your plant. Submit samples and prints for a comparison with your present method.

VERTICAL DRILLING MACHINES
VERTICAL TAPPING MACHINES
VERTICAL THREADING MACHINES
TWO SPINDLE MACHINES
ANGULAR MACHINES
NUT TAPPING MACHINES
HORIZONTAL MACHINES
DRILLING AND TAPPING UNITS
AUTOMATIC JIGS AND FIXTURES
DRILL PRESS TAP HEADS

SNOW

MANUFACTURING COMPANY

435 EASTERN AVENUE, BELLWOOD, ILL.

(Suburb of Chicago)

For more information fill in page number on Inquiry Card, on page 223

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Van Norman Mch. Co., Springfield, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

GRINDING MACHINES, Thread

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch Co., Springfield, Vt.
Landis Machine Co. (Centerless), Waynesboro, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING MACHINES, Universal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Frauenthal Div., Muskegon, Mich.
Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mich.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Parker-Majestic, Inc., 147 Joseph Campau, Detroit, Mich.
Springfield Mch. Tool Co., 613 W. Southern Ave., Springfield, Ohio

GRINDING WHEEL DRESSING AND FORMING DEVICES

DoAll Co., Des Plaines, Ill.
Jones & Lamson Mch. Co., Springfield, Vt.
Metal Carbides Corp., Youngstown, Ohio
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio

GRINDING WHEELS

Blanchard Machine Co., 64 State St., Cambridge, Mass.
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Cincinnati Milling Products Div., Cincinnati 9, Ohio
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Michigan
Metal Carbides Corp., Youngstown, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley St., Bridgesburg, Philadelphia, Pa.

GROOVING TOOLS, Internal

Scully-Jones & Co., 1906 So. Rockwell St., Chicago 8, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

HAMMERS, Drop—See Forging Hammers

HAMMERS, Portable Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Aurora, Ill.

HAMMERS, Portable Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., 175 N. State St., Aurora, Ill.

HAMMERS, Power

Chambersburg Engrg. Co., Chambersburg, Pa
Edlund Mchry. Co. Div., Cortland, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

HARDENING FURNACES

General Electric Co., Schenectady, N. Y.
Holcroft & Co., 6545 Epworth Blvd., Detroit 10, Mich.

HARDNESS TESTERS

Shore Instrument & Mfg. Co., 90-35C Van Wyck Exp., Jamaica 35, N. Y.
Wilson Mechanical Instrument Co., Inc., 230-D Park Ave., New York, N. Y.

HEAT-TREATING EQUIPMENT—See Annealing Furnaces, Flame Hardening Machines, Induction-heating Equipment

HOBS

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Goddard & Goddard Co., Detroit, Mich.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Star Cutter Co., 34500 Grand River, Farmington, Mich.

HOISTS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

HOISTS, Electric

Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

HONING MACHINES

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
Van Norman Mch. Co., 3640 Main St., Springfield 7, Mass.

HONING STONES

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.

HOSE

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

HYDRAULIC MACHINERY
Tools and equipment

Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.

(Continued on page 302)

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Motch & Merryweather Machinery Co., Penton Bldg., Cleveland, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

HYDRAULIC POWER UNITS OR TOOL HEADS

Barnes Drill Co., 814 Chestnut, Rockford 3, Ill.
Barnes, W. F. & John Co., 201 S. Waterford St., Rockford, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Div. of Sperry Rand Corporation, 1402 Oakman Blvd., Detroit, Mich.

INDEXING and SPACING EQUIPMENT

Austin Industrial Corp., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Morris, Robert E. Co., W. Hartford, Conn.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Mch., 3640 Main St., Springfield 7, Mass.
Wadell Equip. Co., Clark, N. J.
Western Machine Tool Works, Holland, Mich.

INDICATOR BASES, Magnetic

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
duMont Corp., 289 Wells St., Greenfield, Mass.
Starrett, L. S., Co., Athol, Mass.

INDICATOR LIGHTS—See Lights, Indicator

INDICATORS, Dial

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Lufkin Rule Co., Saginaw, Mich.
National Automatic Tool Co., S. 7th-N. Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S. Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
General Electric Co., Schenectady, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Test

Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
National Automatic Tool Co., S. 7th & N Sts., Richmond, Ind.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The, L. S., Co., Athol, Mass.

INDUCTION HEATING EQUIPMENT

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
General Electric Co., Schenectady, N. Y.
Lepel High Frequency Laboratories, Inc., Woodside 77, N. Y.
Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

INSPECTION EQUIPMENT, Ultrasonic

Curtiss-Wright Corp., Caldwell, N. J.

INTENSIFIERS, Hydraulic

Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Roselle, N. J.

JACKS, Planer—See Set-up Equipment

JIG BORERS

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cleereman Machine Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio
Homestrand, Inc., Larchmont, N. Y.
M. B. I. Export & Import, Ltd., 475 Grand Concourse, New York 51, N. Y.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

JIGS AND FIXTURES

Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Metal Carbides Corp., Youngstown 12, Ohio
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 28, Mich.
Portage Mch. Co., 1025 Sweitzer Ave., Akron 11, Ohio
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

KEYSEATERS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Bliss, E. W. Co., Canton, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
Mitts & Merrill, 1809 S. Water St., Saginaw, Mich.

KNURLING TOOLS

Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Illinois
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350 Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LAPPING MACHINES

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio

(Continued on page 304)

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.)
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Size Control Co., Div. of American Gage & Mch. Co., 2500 W. Washington Blvd., Chicago 12, Ill.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

LATHE ATTACHMENTS

Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

LATHES, AUTOMATIC—See Chucking Machines

LATHES, Axle

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Farrel-Birmingham Co., Inc., Rochester 10, N. Y.
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Levin, Louis & Son, Los Angeles 21, Calif.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Car Wheel

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bullard Co., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.

LATHES, Copying, Duplicating

Pilot Div., Cone Automatic Mch. Co., 30 Rockefeller Plaza, New York, N. Y.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Double-End

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Duplicating

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

LATHES, Engine, Manufacturing

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Eustacchio, S., Brescia, Italy
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

(Continued on page 306)

For more information fill in page number on Inquiry Card, on page 223

NOW
U.S. SAVINGS BONDS
PAY YOU HIGHER INTEREST
FASTER!

If you've always bought U.S. Savings Bonds for their rock-ribbed safety, their guaranteed return, the way they make saving easier—you've got one more reason now!

Every Series E United States Savings Bond you've bought since February 1, 1957 pays you a new, higher interest—3¼% when held to maturity! It reaches maturity *faster*—in only 8 years and 11 months. And redemption values are higher, too, especially in the earlier years.

About your older Bonds? Easy. Just hold onto them. As you know, the rate of interest a Savings Bond pays increases with each year you own it, until maturity. Therefore, the best idea is to *buy the new—and hold the old!*

The main thing about E Bonds, of course, is their complete safety. Principal and interest are fully guaranteed. They are loss-proof, fire-proof, theft-proof—because the Treasury will replace them without charge in case of mishap. Your Savings Bonds are as solid as a rock—backed by the full faith and credit of the United States.

Maybe you already know about Savings Bonds—as one of the 40 million Americans who own them today, or as one of the other millions who have used Bond savings to help pay for new homes, cars, or college educations, or to make retirement financially easier. If so, this is familiar territory to you—you *know* there's no better way to save.

But if you're new to the game, find out about Savings Bonds and what they can do for your future. Ask your banker, or check with your employer about the automatic Payroll Savings Plan that makes saving painless and easy.

PART OF EVERY AMERICAN'S SAVINGS

BELONGS IN U. S. SAVINGS BONDS

The U.S. Government does not pay for this advertisement. It is donated by this publication in cooperation with the Advertising Council and the Magazine Publishers of America.

PUBLIC SERVICE ADVERTISING COUNCIL

Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Engine, Toolroom

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Barber-Colman Co. (Hendey Mch. Div.), Rockford, Ill.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Co., Sidney, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio
Western Machine Tool Works, Holland, Mich.
Wickes Brothers, 512 No. Water St., Saginaw, Mich.

LATHES, Gap

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Homestrand, Inc., Larchmont, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Sidney Machine Tool Co., Sidney, Ohio
Springfield Mch. Tool Co., Springfield, Ohio

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Roll

American Tool Works Co., Cincinnati 2, Ohio
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Bliss, E. W., Co., Canton, Ohio
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

LATHES, Speed, Second-operation

Atlas Press Co., Kalamazoo, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., Cincinnati 25, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio

Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic

Atlas Press Co., Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type, Saddle Type

Atlas Press Co., Kalamazoo, Mich.
Bardons & Oliver Inc., Ft. W. 9th St., Cleveland 13, Ohio
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Levin & Son, Inc., Louis, Los Angeles 8, Calif.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.
Seneca Falls, Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Wks., South Bend 22, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret Vertical—See Boring Mills, Vertical

LAYOUT and DRAFTING TOOLS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Starrett, L. S., Co., Athol, Mass.

LEVELS

Lufkin Rule Co., Saginaw, Mich.
South Bend Lathe Wks., South Bend 22, Ind.
Starrett, The L. S., Co., Athol, Mass.

LIGHTS, Indicator

General Electric Co., Schenectady, N. Y.

LIMIT SWITCHES—See Switches, Limit

LUBRICATING OILS and GREASES

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Lubriplate Div., Fiske Bros. Refining Co., 120 Lockwood St., Newark 5, N. J.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio
Gits Bros. Mfg. Co., 1846 S. Kilbourn Ave., Chicago 23, Ill.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., Niles, Ill.

MACHINERY, Used and Rebuilt

Eastern Mchry. Co., 1000 Tennessee Ave., Cincinnati, Ohio
Miles Mchry. Co., 2025 E. Genessee Ave., Saginaw, Mich.
Van Keuren Co., Watertown 72, Mass.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

MACHINISTS' SMALL TOOLS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Lufkin Rule Co., Saginaw, Mich.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Starrett, The, L. S., Co., Athol, Mass.

MANDRELS—See Arbors and Mandrels

MARKING MACHINES and DEVICES

Colonial Broach & Machine Co., P. O. Box 37, Harper Sta., Detroit 13, Mich.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

MEASURING MACHINES

Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Van Keuren Co., Watertown 72, Mass.

MEASURING WIRES, Thread, Spline, Gear

Sheffield Corp., Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROMETER HEADS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoAll Co., Des Plaines, Ill.
Starrett, The L. S., Co., Athol, Mass.

MICROMETERS, Outside, Inside, Depth

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., Watertown 72, Mass.

MICROSCOPES, Toolmakers'

Bausch & Lomb Optical Co., Rochester, N. Y.
DoAll Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

Skinner power chucking equipment makes old lathes perform

Better than New!

It's easy to convert your present lathes to Skinner power—and the savings will start at once. Automatically, you'll have high-production machines that slash your over-all machining time and costs.

Take Skinner Power Chucks, for example. Gripping and releasing are done instantly by compressed air. Hand wrenching is eliminated—work goes faster, is far less tiring. Consider what this feature alone will save you on every job!

For turning between centers, famous Skinner-distributed **+GF+** Work Drivers need only an easy half-turn of the hood for fast, sure clamping. Here, too, speed means savings. Work Drivers grip out-of-round work evenly, match clamping force to cutting pressure, drive any round or smooth blanks, from 1/4″ to 8 1/16″.

No wonder more and more manufacturers are turning to Skinner with all their power chucking needs. Let us show you how the wide range of Skinner power chucking equipment can modernize your lathes!

Send for specifications, applications and installation instructions. Write Dept. 158.

Skinner Power Chucks and air cylinders are available in a wide range of sizes. The "Junior" power chucking unit shown here will convert most small lathes to a high-production, more economical machine. The complete unit consists of double-acting 6″ cylinders, adapters, regulators, valve and 8″ self-centering chuck with gripping capacity from ¼″ to 6″. Individual components are also available separately.

Here a manufacturer uses a **+GF+** Work Driver to replace driving dogs on a Monarch Tracing Lathe. The lathe is used to make jig borer lead screws and the part must be removed at least five times for the entire operation. Think of the savings here, when hand wrenching was eliminated!

Skinner Power Chucks and +GF+ Work Drivers are available through leading Industrial Distributors everywhere.

SKINNER CHUCKS

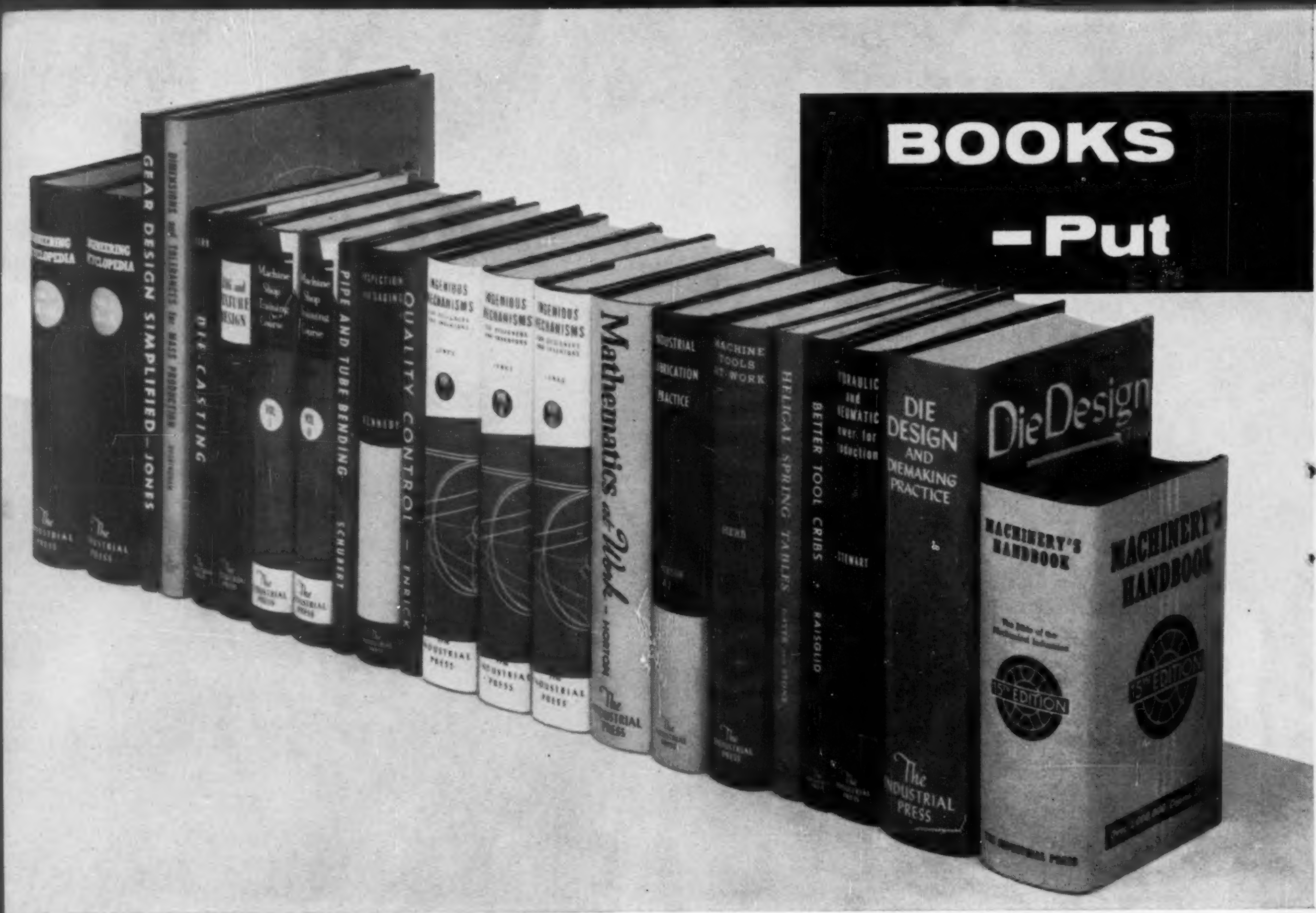
THE SKINNER CHUCK COMPANY

ESTABLISHED 1887

NEW BRITAIN, CONNECTICUT

BOOKS

–Put



MACHINERY'S HANDBOOK— 15th Edition

A modern handbook is a necessity for every man who holds or hopes to hold a responsible job in the mechanical industries. This one is the "Bible" of them all. The latest edition of this world-renowned book combines all the valuable features of earlier editions with the most recent and useful machine-designing and machine-shop data obtainable. Over a million copies in use. 1911 Pages, Thumb Indexed.

$9.00 In Canada or overseas, $10.00.

THE USE OF HANDBOOK TABLES AND FORMULAS

A companion book for users of MACHINERY'S HANDBOOK which shows you how to get the most out of your Handbook. Examples, solutions and test questions show typical applications of Handbook matter in both drafting-rooms and machine shops.

$2.00 Special combination price with MACHINERY'S HANDBOOK, $10.50

In Canada or overseas, $2.10. Special combination price, $11.50.

HELICAL SPRING TABLES—

by John D. Gayer and Paul H. Stone, Jr.

An easy-to-use index of over 6800 ready-designed compression and tension springs from which selections may be made with minimum calculation—even if you are not familiar with spring design. 165 Pages.

$5.00 In Canada or overseas, $5.75.

DIE DESIGN AND DIEMAKING PRACTICE—

3rd Edition—by Franklin D. Jones

Drawings and descriptions of a tremendous variety of dies and a vast amount of data to help you avoid expensive mistakes and delays. This is a standard reference work in the metal-working industries, and has been used by some 40,000 diemakers, designers and tool engineers. 661 Illustrations. 1083 Pages.

$8.00 In Canada or overseas, $9.05.

DIMENSIONS AND TOLERANCES FOR MASS PRODUCTION—

by Earle Buckingham

An analysis of the many problems of dimensioning with tolerances for mass production, showing their effect on tool design, gage design, production and inspection, and suggesting improved methods and practices to solve these problems. 179 Illustrations. 164 Pages.

$8.00 In Canada or overseas, $8.85.

ENGINEERING ENCYCLOPEDIA—

by Franklin D. Jones

Condensed and practical information on 4500 subjects definitions of numerous terms used in engineering and manufacturing practice, the results of many costly and important tests and experiments. No single work will give you a broader knowledge with less reading effort. 206 Drawings. 1431 Pages.

Two Volumes, $10.00

In Canada or overseas, $11.35.

INDUSTRIAL LUBRICATION PRACTICE

by Paul D. Hobson

A practical working manual covering motors, engines, turbines, compressors, refrigeration equipment, machine tools, pneumatic and hydraulic tools, and other industrial and marine equipment . . . with chapters on oil purification and reclamation, the use of cutting fluids, and the storage preservation of machinery. 167 Illustrations. 534 Pages.

$8.00 In Canada or overseas, $8.95.

INSPECTION AND GAGING—

by Clifford W. Kennedy

Discusses the specific functions of manual and automatic measuring devices and gages and the specialized techniques of using them. In addition, it analyzes the methods and duties of the different types of inspectors. Ideal for use in the plant or as a training course text. 317 Illustrations. 512 Pages.

$8.00 In Canada or overseas, $8.95.

BETTER TOOL CRIBS—

by William Raisglid

Shows with detailed examples how to organize and operate an efficient tool crib with maximum benefits, and how to avoid wasteful, haphazard methods of tool crib operation. In addition, complete control systems based on the use of brass tool checks and triplicate tool charge slips are clearly described. 87 Illustrations. 152 Pages.

$4.00 In Canada or overseas, $4.75.

MILLING MACHINE ATTACHMENTS

Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Machinery Corp., Yonkers, N. Y.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench, Hand

Atlas Press Co., Kalamazoo, Mich.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Morris, Robert E. Co., W. Hartford, Conn.

MILLING MACHINES, Bed Type, Simplex, Duplex

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Morris, Robert E. Co., W. Hartford, Conn.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Circular, Continuous

Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Die Sinking, Duplicating, Profiling

Arrow Engineering Co., Inc., 120 E. Market St., Indianapolis, Ind.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Colonial-Romulus Div., Parkgrove Station, Detroit 5, Mich.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Morey Machinery Co., 383 Lafayette St., New York, 3, N. Y.
Onsrud Machine Works, Inc., Niles, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Knee Type, Horizontal, Plain, Universal

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Ferndale, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Rise and Fall

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

MILLING MACHINES, Knee Type Ram

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Turret

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical

Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Atlas Press Co., Kalamazoo, Mich.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Calif.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Homestrand, Inc., Larchmont, N. Y.
Kearney & Trecker Corp., Milwaukee, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
South Bend Lathe Wks., South Bend 22, Ind.

MILLING MACHINES, Planer Type

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Spar

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.

MILLING MACHINES, Thread

Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.

MOLDING MACHINES, Plastic

Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

MOTORS, Electric

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Howell Electric Motors Co., Howell, Mich.
Lincoln Electric Co., Cleveland 17, Ohio
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio

MOTORS, Hydraulic

Barnes, J. S., Corp., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee Wis.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

MULTIPLE-STATION MACHINES, Dial Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Prod. Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
LaSalle Tool, Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.

(Continued on page 312)

For more information fill in page number on Inquiry Card, on page 223

National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

MULTIPLE-STATION MACHINES, Transfer Type

Avey Drilling Mch. Co., 25 E. 3rd St., Covington, Ky.
Baker Bros., Inc., 1000 Post St., Toledo 10, Ohio
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Baush Mch. Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., Milwaukee, Wis.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Modern Industrial Engrg. Co., 14230 Birwood Ave., Detroit 38, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.

NIBBLING MACHINES

Fenway Machine Co., Inc., Willow Grove, Penna.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Wales-Strippit Corp., Akron, N. Y.

NICKEL AND NICKEL ALLOYS

Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.

NUT SETTERS—See Screwdrivers, etc.

NUTS—See Bolts, Nuts and Screws

OIL GROOVERS

Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

OILERS AND LUBRICATORS

Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

OILS, CUTTING SOLUBLE—See Cutting and Grinding Fluids

OILS, Lubricating—See Lubricating Oils and Greases

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 - 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan Ave., Chicago 80, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
DoAll Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Van Keuren Co., Watertown 72, Mass.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Watson-Stillman Co., Roselle, N. J.

PAINTING EQUIPMENT, Spray—See Spraying Equipment, Metal

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., Des Plaines, Ill.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Lufkin Rule Co., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PIPE, Steel, Stainless, etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co. (Tubular Prod. Div.), Beaver Falls, Penna.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

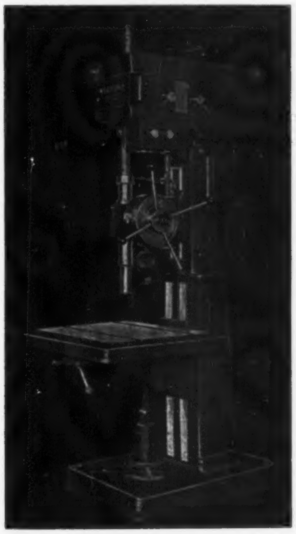
PIPE AND TUBING MILLS, Electric-weld

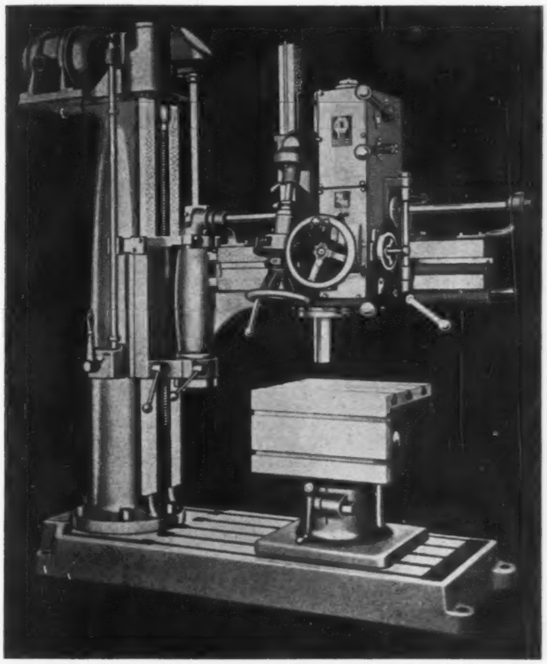
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

PIPE AND TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.

WESTERN UPRIGHT DRILLS —Single or multiple spindle; 18 speeds; 9 feeds; all geared; up to 2½" capacity.



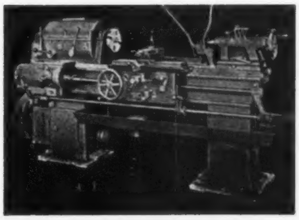


THE BIG 4 WESTERN LINE

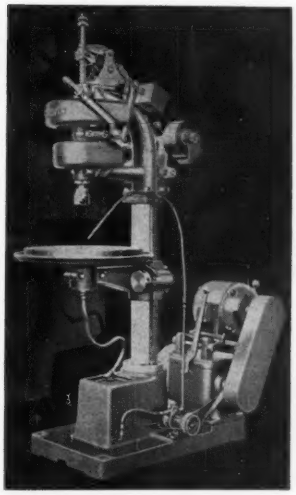
"RELIABLE—SINCE 1895"

WESTERN HIGH SPEED RADIAL DRILLS — Ball Bearing Equipped — 12 Speeds — 40 to 2000 R.P.M. — Double Low-Hung Drive — 6 Geared Feeds.

CHARD LATHES — Quick change, geared head; 16", 18" and 20" swing, 8 or 12 speeds.



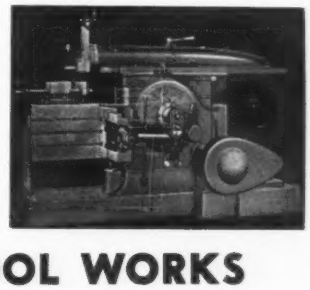
GARVIN AUTOMATIC TAPPERS—Up to 3" pipe tap capacity; four spindle speeds.



WESTERN **High Speed Radial Drills** have a range of spindle speeds from 40 to 2000 R.P.M. making them versatile machines for practically all radial drill uses. They are made in 3, 3½, 4, 4½, 5 and 6 foot arm lengths. The radial drill contains a stationary box type column with hand-scraped ways for the saddle. The speed box, mounted on top of the column, contains the elevating mechanism and drive bevels of hardened alloy steel. One motor of constant speed supplies all of the motive power. Ball Bearing throughout, "Double Low Hung Drive," hardened gearing—6, 12 or 18 speeds—6 feeds—with all heavy duty types, 3 to 8 ft. arms, up to 3" drill capacity in steel. Full line of accessory equipment.

For more information on these and other machines in the Big 4 line write for catalogs. Specify capacity desired.

STEPTOE SHAPERS — 14" to 24" Heavy Duty; 12" and 15" High Speed, up to 200 strokes per minute.



MANUFACTURED BY

WESTERN MACHINE TOOL WORKS

HOLLAND, MICHIGAN, U.S.A.

For more information fill in page number on Inquiry Card, on page 223

PIPE THREADING AND CUTTING MACHINES

Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Landis Machine Co., Inc., Waynesboro, Pa.
Sheffield Machine Co., Inc., Waynesboro, Pa.

PLANER JACKS—See Set-up Equipment

PLANERS, Double Housing and Openside

Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Consolidated Mch. Tool Div., Rochester, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seewald Inc., 1956 Woodbridge Ave., New Brunswick, N. J.

PLASTICS AND PLASTIC PRODUCTS

Dow Chemical Co., Midland, Mich.
Eastman Kodak Co., 343 State St., Rochester 4, N. Y.
Gisholt Mch. Co., Madison, Wis.
U. S. Steel Corp., Nat'l Tube Div., Pittsburgh, Pa.

PRESS BRAKES—See Brakes, Presses and Bending

PRESS FEEDERS, Automatic

Bliss Co., E. W., Canton, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., East Orange, N. J.

PRESSES, Arbor

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
du Mont Corp., Greenfield, Mass.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Logansport Machine Co., Inc., Logansport, Ind.
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Assembling

Alva Allen Industries, Clinton, Mo.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Colonial Broach & Machine Co., Box 37, Detroit 13, Mich.
Detroit Broach Co., Inc., 950 S. Rochester Rd., Rochester, Mich.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Blanking, Stamping

Alva Allen Industries, Clinton, Mo.
Alpha Press & Machine, Inc., 9281 Freeland Ave., Detroit 28, Mich.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bath, Cyril Co., 32324 Solon Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Federal Machine & Welder Co., 1745 Overland Ave. N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 N. 18th St., East Orange, N. J.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Briquetting

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Closed-Die Forging

Ajax Manufacturing Co., 1441 Chardon Rd., Cleveland 17, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd. S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Coining, Embossing

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Die Sinking (Hobbing)

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Die Tryout

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Drawing

Alva Allen Industries, Clinton, Mo.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Cincinnati Milling & Grinding Machines, Inc., 4710 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Extrusion

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Foot

Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Arcade, N. Y.

PRESSES, Horning

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton Ohio
Clearing Machine Corp., 6499 W. 65th St. Chicago 38, Ill.

(Continued on page 316)

Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Notching

Alva Allen Industries, Clinton, Mo.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit Corp., Akron, N. Y.
Wilson, K. R., Inc., Arcade, N. Y.

PRESSES, Punching, Piercing

Alva Allen Industries, Clinton, Mo.
Bath Cyril Co., 32324 Aurora Rd., Solon, Ohio
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7400 S. Loomis Blvd., Chicago 36, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
Verson Allsteel Press Co., 9309 S. Kenwood, Chicago 19, Ill.
Wales-Strippit Co., Akron, N. Y.
Wiedemann Machine Co., 4272 Wissahicken Ave., Philadelphia 32, Pa.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Quenching

Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.

PRESSES, Rubber-Forming

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

PRESSES, Trimming

Alva Allen Industries, Clinton, Mo.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 S. Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wilson, K. R., Inc., Arcade, N. Y.

PROFILING MACHINES—See Milling Machine, Die Sinking, etc.

PULLEYS

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio
Viking Pump Co., Cedar Falls, Iowa

PUMPS, Hydraulic

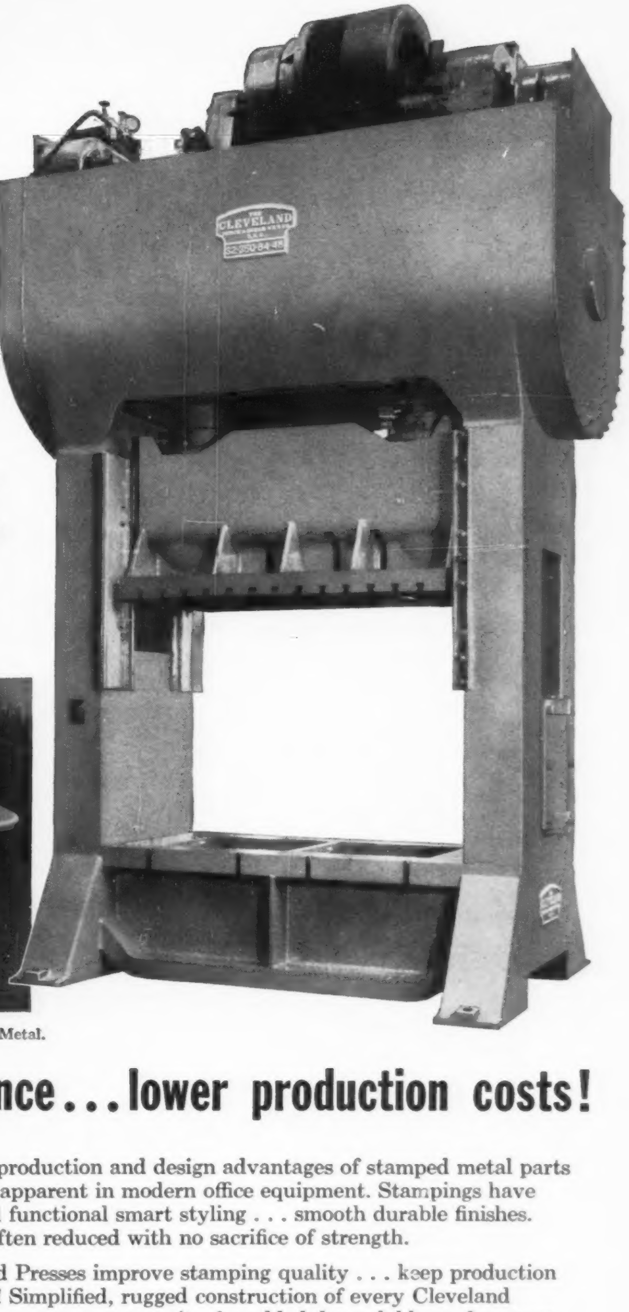
Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa
Watson-Stillman Co., Roselle, N. J.
Wilson, K. R., Arcade, N. Y.

PUNCHES AND DIES—See Dies, Blanking, etc.

REAMERS, Rose, Chucking, Jobbers', Taper, Shell, Adjustable, etc.

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Goddard & Goddard Co., Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Heller Tool Co., Heller Dr., Newcomerstown, Ohio
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

Streamlined
Cleveland Presses



Stampings are an important part of smartly styled office furniture by Art Metal.

offer maximum performance...lower production costs!

The many production and design advantages of stamped metal parts are readily apparent in modern office equipment. Stampings have contributed functional smart styling . . . smooth durable finishes. Weight is often reduced with no sacrifice of strength.

Cleveland Presses improve stamping quality . . . keep production costs down! Simplified, rugged construction of every Cleveland Press gives you reserve capacity for added dependable performance. Sturdy cast or welded frames strengthen and minimize deflection under rated capacity, assure stamping accuracy . . . longer die life. And the exclusive Cleveland Clutch® minimizes down time—lowers maintenance costs.

Each of the 11 types of Cleveland Presses—standard yet special in every fine detail—is available in a wide range of sizes designed to give CLEVELAND users maximum press performance, safety and economy. Regardless of the job, we invite you to write or call for complete information to THE CLEVELAND PUNCH AND SHEAR WORKS COMPANY, East 40th and St. Clair Ave., Cleveland 14, Ohio.

Offices at: New York • Chicago • Detroit • Philadelphia • East Lansing • Cincinnati

Power Presses
Fabricating Tools
Punching Tools & Dies

THE
CLEVELAND
PUNCH & SHEAR WORKS CO.
Established 1880

For more information fill in page number on Inquiry Card, on page 223

REELS, Stock
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORS, Heat-Treating Furnaces
Norton Co., 1 New Bond St., Worcester 6, Mass.

RETAINING RINGS FOR BEARINGS, Etc.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RIVETERS, Stationary
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Grant Mfg. & Mch. Co., 90 Silliman Ave., Bridgeport 5, Conn.
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

RIVETERS, Portable
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hannifin Corp., 510 So. Wolf Rd., Des Plaines, Ill.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

RULES, SCALES AND STRAIGHTEDGES—See Machinists' Small Tools

RUST INHIBITORS
Oakite Products, Inc., 19 Rector St., New York N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Stuart, D. A. Oil Co. Ltd., 2727 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia 3, Pa.

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

SAW BLADES, Hack, Band, Circular, Friction
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Mach. Works, Philadelphia, Pa.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S. Co., Athol, Mass.
Tannewitz Works, Grand Rapids, Mich.

SAW BLADE SHARPENERS
DoAll Co., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

SAWING MACHINES, Band –
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Tannewitz Works, Grand Rapids, Mich.

SAWING MACHINES, Circular Blade
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.

SAWING MACHINES, Power Hack
Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Racine Hydraulics & Machinery Inc., Racine, Wis.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.

SAWS, Screw-slotting—See Cutters, Milling

SCALES
Hydroway Scales, Inc., 31302 Stephenson Hwy., Madison Hts., Mich.

SCREW DRIVERS, STUD AND NUT SETTERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Errington Mech Lab., Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Scully-Jones & Co., 1906 S. Rockwell St., Chicago 8, Ill.
Thor Power Tool Co., Prudential Plaza, Chicago 1, Ill.
Williams & Co., J. H., 400 Vulcan St., Buffalo 7, N. Y.

SCREW MACHINES, Hand—See Lathes, Turret, Ram-type, Saddle-type

SCREW MACHINES, Single-Spindle Automatic
Aaron Machinery Co., Inc., 45 Crosby St., New York 12, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., N. Y. 17, N. Y.

SCREW MACHINES, Multiple-Spindle Automatic
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

SCREW PLATES
Greenfield Tap & Die Corp., Greenfield, Mass.

SCREWS, Cap, Set, Self-tapping, etc.—See Bolts, Nuts and Screws

SEALS AND RETAINERS, Oil or Grease
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Gits Bros. Mfg. Co., 1858 S. Kilbourn Ave., Chicago, Illinois

SEPARATORS, Magnetic
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

SET-UP EQUIPMENT
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Challenge Mchry. Co., Grand Haven, Mich.
Lufkin Rule Co., Saginaw, Mich.
Starrett, The, L. S., Co., Athol, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

SHAFTS
Cumberland Steel Co., 101 Williams St., Cumberland, Md.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Thomson Ind., Inc., Manhasset, N. Y.

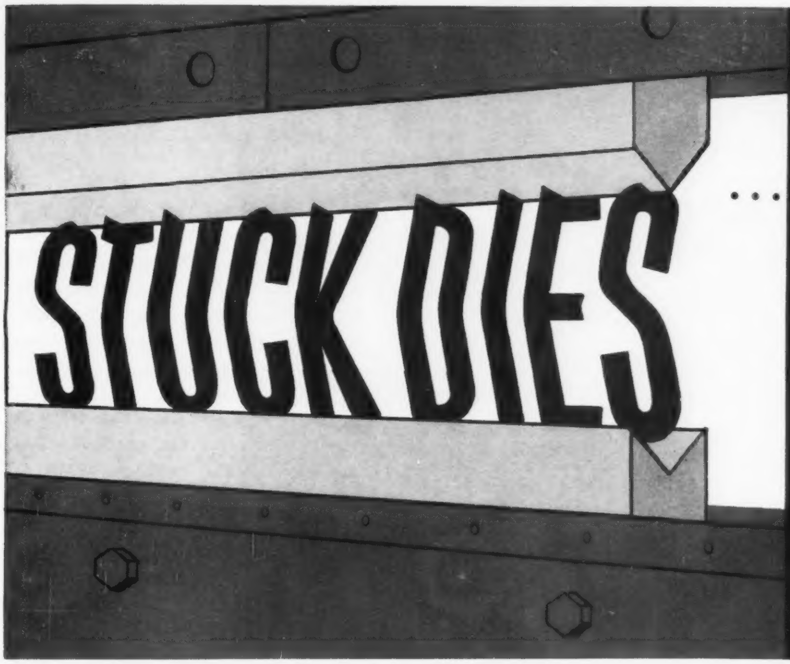
SHAPERS, Crank and Hydraulic
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Homestrand, Inc., Larchmont, N. Y.
Nebel Machine Tool Corp., 3401 Central Pkwy., Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Western Machine Tool Works, Holland, Mich.

SHAPERS, Vertical and Slotters
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Morey Machinery Co., 383 Lafayette St., New York 3, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio

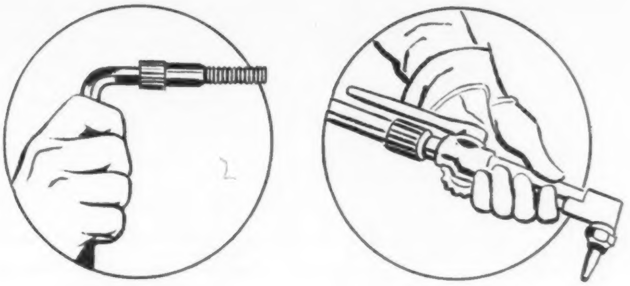
SHEARS, Rotary and Squaring
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Cincinnati Shaper Co., Hopple & Garrard, Cincinnati 25, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.

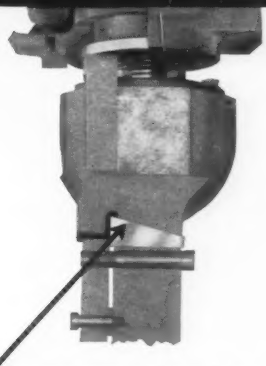
SHEARS, Squaring
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.



. . . . quickly, easily released with exclusive patented LODGE & SHIPLEY

WEDGE TYPE RAM PRESSURE RELEASE





THIS . . . NOT THIS!

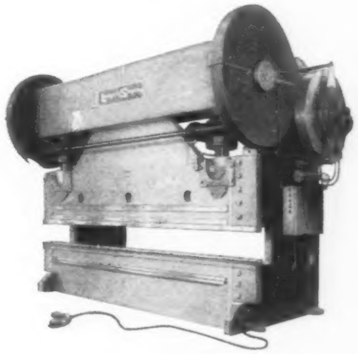
- **Use wrench . . . . not a cutting torch**
- **in minutes . . . . instead of hours**
- **without damage . . . . die holder destroyed**

The Lodge & Shipley Wedge Type Ram Pressure Release is unusually simple and rugged in design. A heavy steel wedge has a top angle that complements a similar angle on the base of the ram pittman socket housing. Held securely by a heavy steel plate, the wedges can be released quickly to provide up to ¼" additional clearance.

When a press brake is stalled due to improperly adjusted dies . . . do you face a short delay or near disaster?

With a Lodge & Shipley Press Brake, release of the stuck dies is a quick, simple, non-destructive matter as described in the accompanying detail.

This is but one of many outstanding Lodge & Shipley Press Brake features designed for fast, accurate, efficient and dependable press brake operation. New literature gives complete details. Write: **The Lodge & Shipley Co., 3057 Colerain Ave., Cincinnati 25, Ohio.**



Lodge & Shipley *. . . your Lodge-ical choice*

L

For more information fill in page number on Inquiry Card, on page 223

SHEET METALS—See Strip and Sheet, Ferrous, Non-ferrous

SHIM STOCK

Laminated Shim Co., Inc., Glenbrook, Conn.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

SHOP FURNITURE—See Furniture, Shop

SLITTING MACHINES, Rotary

Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo 11, N. Y.
Yoder Co., 5504 Walworth Ave., Cleveland 2, Ohio

SLOTTERS—See Shapers, Vertical and Slotters

SOCKETS—See Drill Sleeves and Extension Holders

SOLENOIDS

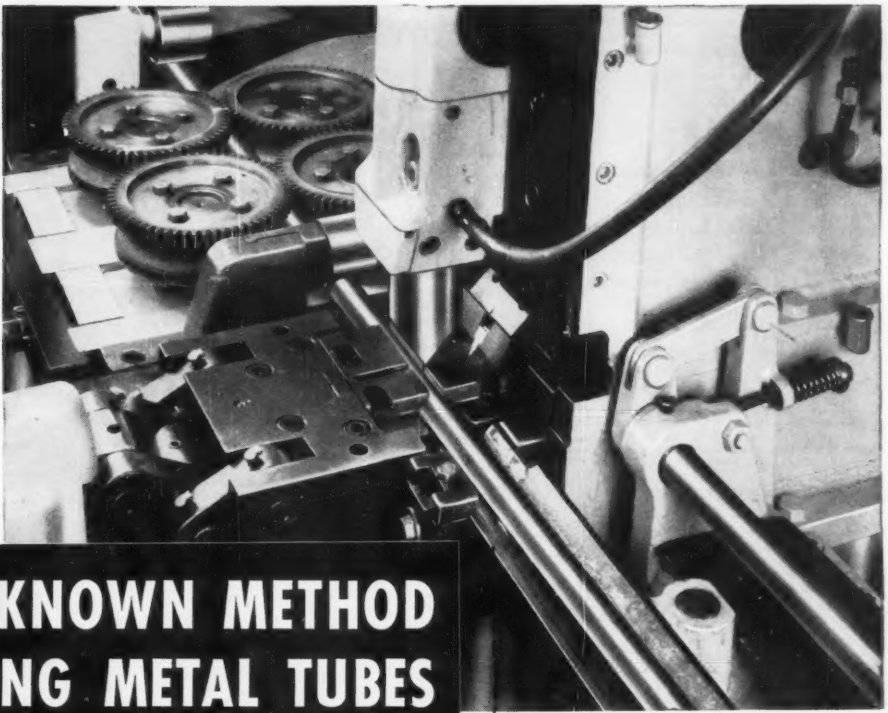
Allen-Bradley Co., 1331 S. 1st St., Milwaukee 4, Wis.
Barnes, John S. Corp., Rockford, Ill.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
Vickers, Inc., Detroit 32, Mich.

SPECIAL MACHINERY AND TOOLS

Axelson Mfg. Co., 6160 S. Boyle Ave., Los Angeles 58, Cal.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Baldwin-Lima-Hamilton Corp., Eddystone Div., Philadelphia 42, Pa.
Baldwin-Lima-Hamilton Corp., Lima Hamilton Div., Hamilton, Ohio
Baker Bros., Inc., Sta. F., P.O. Box 101, Toledo 10, Ohio
Bath, Cyril Co., Aurora & Solon Road, Solon, Ohio
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Buhr Mch. Tool Co., 835 Green St., Ann Arbor, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Colonial Broach & Machine Co., P.O. Box 37, Harper Sta., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Consolidated Mch. Tool Corp., Rochester, N. C.
Coulter, James, Machine Co., Bridgeport 5, Conn.
Cross Co., Detroit, Mich.
Erie Foundry Co., Erie, Pa.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Federal Machine & Welder Co., Overland Ave., Warren, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros., & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 501 S. Wolf Rd., Des Plaines, Ill.
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
National Acme Co., 170 E. 131st St., Cleveland, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Robbins, Omer E. Co., 24800 Plymouth Rd., Detroit 39, Mich.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Sundstrand Mch. & Tool Co., 2531 11th St., Rockford, Ill.
Universal Engrg. Co., Frankenmuth 2, Mich.
Verson Allsteel Press Co., 93rd St., & S. Kenwood Ave., Chicago, Ill.

(Continued on page 322)

For more information fill in page number on Inquiry Card, on page 223



FASTEST KNOWN METHOD OF CUTTING METAL TUBES

Automatic continuous operation of up to 6,500 cut-offs per hour is approximately 3 to 8 times greater than the speed of competitive methods.

Cutting action in Grieder Tube Cut-off Machines is accomplished by two blades actuated by a crankshaft. A horizontal cut is made first, through the wall thickness of the top of the tube. The vertical blade descends into the opening and completes the cut. The tubing is held firmly in dies which operate as a vise preventing any distortion. Lengths can be held to plus or minus .002″ on light wall tubing and to approximately .003″ on heavier wall tubing.

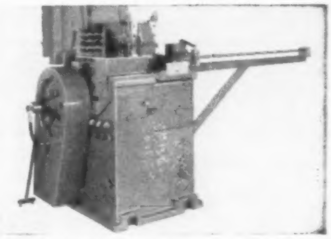
Automatic hoppers for feeding tubes and related automation equipment are available in conjunction with Grieder Tube Cut-off Machines for specific applications. Tell us what you want to accomplish.

Grieder Tube Cut-off Machines are slicing tubes and slashing costs in most major industries. Write for literature.

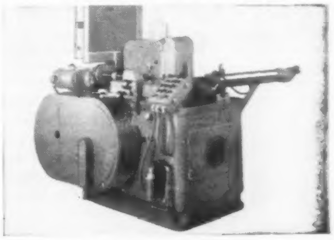
GRIEDER INDUSTRIES, INC.

P. O. BOX 169, BOWLING GREEN, OHIO

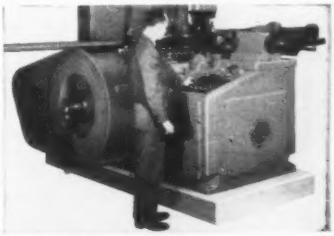
THREE STANDARD MODELS



NO. 1000-MAC cuts tubes up to ¾″ OD and up to .062″ wall thickness.



NO. 2000-MAC cuts tubes up to 2″ OD and up to .125″ wall thickness.



NO. 4000-MAC cuts tubes up to 4″ OD and up to .250″ wall thickness.

Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

SPEED REDUCERS

Barnes, John S. Corp., Rockford, Ill.
Boston Gear Works, 320 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 So. Cicero Ave., Chicago 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio
Cone Drive Gear Div., 7171 E. McNichols Rd., Detroit 12, Mich.
DoAll Co., Des Plaines, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott Co., 5114 Hamilton, Cleveland, Ohio
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Philadelphia Gear Works, Inc., Erie Ave., and G. St., Philadelphia, Pa.
Reliance Elec. & Engrg. Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio

SPINDLES, Machine

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th-N. St., Richmond, Ind.
Pope Mchry. Corp., Haverhill, Mass.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio
Wadell Equip. Co., Clark, N. J.

SPRAYING EQUIPMENT, Metal

Metallizing Engrg. Co., Westbury, N. Y.

SPROCKETS—See Gears, Cut

STAMPINGS, Sheet Metal

Dayton Rogers Mfg. Co., Minneapolis, Minn.
Laminated Shim Co., Inc., Glenbrook, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STEEL, Cold Rolled, Stainless, High-Speed, Tool, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Columbia Tool Steel Co., Chicago Hts., Ill.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Cumberland Steel Co., 101 Williams St., Cumberland, Md.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Timken Roller Bearing Co., Canton, Ohio
U. S. Steel Corp. (American Steel & Wire Co.), Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL DISTRIBUTORS

Ryerson, Jos. T., & Son, 16th & Rockwell St., Chicago 8, Ill.

STOCKS AND DIES

Cyril Bath Co., Solon, Ohio
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

STRAIGHTENERS, Flat Stock and Wire

Bliss Co., E. W., Canton, Ohio
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
Nilson, A. H. Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

STRIP AND SHEET, Ferrous

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp., Div., Columbia Steel Co., Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

STRIP AND SHEET, Non-ferrous

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
New Jersey Zinc Co., 160 Front St., New York N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

STRUCTURAL SHAPES

Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh, 30, Pa.

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Bryant Chucking Grinder Co., Springfield, Vt.
Challenge Mchy. Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
DoAll Co., Des Plaines, Ill.
South Bend Lathe Wks., South Bend 22, Ind.

SWITCHES, Limit

Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

TACHOMETERS—See Indicators, Speed

TAP HOLDERS

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.
Scully-Jones & Co., 1906 Rockwell St., Chicago 8, Ill.

TAPPING HEADS

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Homestrand Inc., Larchmont, N. Y.
LaSalle Tool, Inc., 3480 E. Outer Drive, Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th - N Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio
Chicago Pneumatic Tool Co., New York 17, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Elox Corp. of Mich., 1830 Stephenson Highway, Royal Oak 3, Mich.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Govro-Nelson Co., 1831 Antoinette St., Detroit 8, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Landis Mch. Co., Waynesboro, Pa.
LaSalle Tool Inc., 3840 E. Outer Drive, Detroit 34, Mich.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio
Western Machine Tool Works, Holland, Mich.

TAPS, Hand, Machine Screw, Pipe, etc.

DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hy-Pro Tool Co., New Bedford, Mass.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

THREAD CUTTING MACHINES

Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mach. Lab. Inc., 24 Norwood Ave., Staten Island 4, N. Y.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Dayton 1, Ohio

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Eastern Mch. Screw Corp., New Haven, Conn.
Hanson-Whitney Co., 169 Bartholomew Ave., Hartford 3, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT

Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
National Machinery Co., Tiffin, Ohio
Reed Rolled Thread Die Co., P. O. Box 350 Worcester 1, Mass.
Sheffield Corp., Dayton 1, Ohio
V & O Press Co., Hudson, New York

TOOL CONTROL BOARDS

Cross Co., 3250 Bellevue, Detroit 7, Mich.
Royal Design & Mfg. Inc., 4133 E. 10 Mile Rd., Centerline, Mich.
Scully-Jones Co., 1906 S. Rockwell St., Chicago 8, Ill.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Burg Tool Mfg. Co. Inc., Gardena, Calif.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
Eastern Mch. Screw Corp., Truman & Barclay Sts., New Haven 6, Conn.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio
R & L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
Vascoloy-Ramet Corp., Waukegan, Ill.
Walton Co., Hartford 10, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

TOOL MATERIAL, Cast Non-Ferrous Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Haynes Stellite Co., 725 So. Lindsay St., Kokomo, Ind.
Lovejoy Tool Co., Inc., Springfield, Vt.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cemented Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit 20, Mich.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Metal Carbides Corp., Youngstown 12, Ohio
Valenite Metals Corp., Royal Oak, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL MATERIAL, Ceramic

Metal Carbides Corp., Youngstown 12, Ohio
Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, High-Speed Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 235 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 30, Ill.
Carpenter Steel Co., Reading, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Crucible Steel Co. of America, Oliver Bldg., Pittsburgh 30, Pa.
du Mont Corp., 289 Wells St., Greenfield, Mass.
Eclipse Counterbore Co., 1600 Bonner Ave., Detroit, 20, Mich.
Lovejoy Tool Co., Inc., Springfield, Vt.
Vanadium Alloys Steel Co., Latrobe, Pa.

TRACING ATTACHMENTS
American Tool Works Co., Cincinnati 2, Ohio
Atlas Press Co., Kalamazoo, Mich.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Sidney Mch. Tool Co., Sidney, Ohio
Wales-Strippit Co., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio

TRANSFER MACHINES, Automatic—See Multiple-Station Machines

TRANSMISSION, Variable Speed
Allis-Chalmers Mfg. Co., Milwaukee Wis.
Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland 4, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engrg. Co., 1047 Ivanhoe Rd., Cleveland 10, Ohio
Vickers, Inc., Detroit 32, Mich.

TRUCKS, Material Handling
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio

TUBE-FLANGING MACHINES
Grant Mfg. & Mch. Co., 90 Silliman Ave., Bridgeport 5, Conn.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

TUBE FORMING AND WELDING MACHINES
Yoder Co., 550 Walworth Ave., Cleveland, Ohio

TUBE MILLS
Yoder Co., 550 Walworth Ave., Cleveland, Ohio

TUBING, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson & Son, Inc., Jos. T., 2559 W. 16th St., Chicago 18, Ill.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Babcock & Wilcox Co., Beaver Falls, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
National Tube Div., U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, 2559 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio

TUBE & PIPE CUTTING-OFF MACHINES
Grieder Industries, Inc., Bowling Green, Ohio

ULTRASONIC MCH. TOOLS
Sheffield Corp., Dayton 1, Ohio

UNIT HEATERS, Electric
General Electric Co., Schenectady, N. Y.

VALVE CONTROLS
Barnes, John S. Corp., Rockford, Ill.
Logansport Mch. Co., Inc., Logansport, Ind.
Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.
Vickers, Inc., Detroit 32, Mich.

VALVES, Air
Hannifin Corp., 510 S. Wolf Rd., Des Plaines, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Michigan.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Hunt, C. B., & Son, 1911 E. Pershing St., Salem, Ohio
Hydraulic Press Mfg. Div., Mount Gilead, Ohio
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Roselle, N. J.
Wood, R. D. Co., 1072 Public Ledger Bldg., Philadelphia 5, Penna.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Hghts. Blvd., Detroit 20, Mich.

WELDING EQUIPMENT, Arc
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio
Linde Co., New York 17, N. Y.

WELDING EQUIPMENT, Gas
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Linde Co., New York 17, N. Y.

WELDING EQUIPMENT, Resistance
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Federal Mch. & Welder Co., Warren, Ohio

WELDING POSITIONERS
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

WELDMENTS
Bliss, E. W., Co., Canton, Ohio
Mahon, R. C. Co., Detroit 34, Mich.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

WIPERS
Scott Paper Co., Chester, Pa.

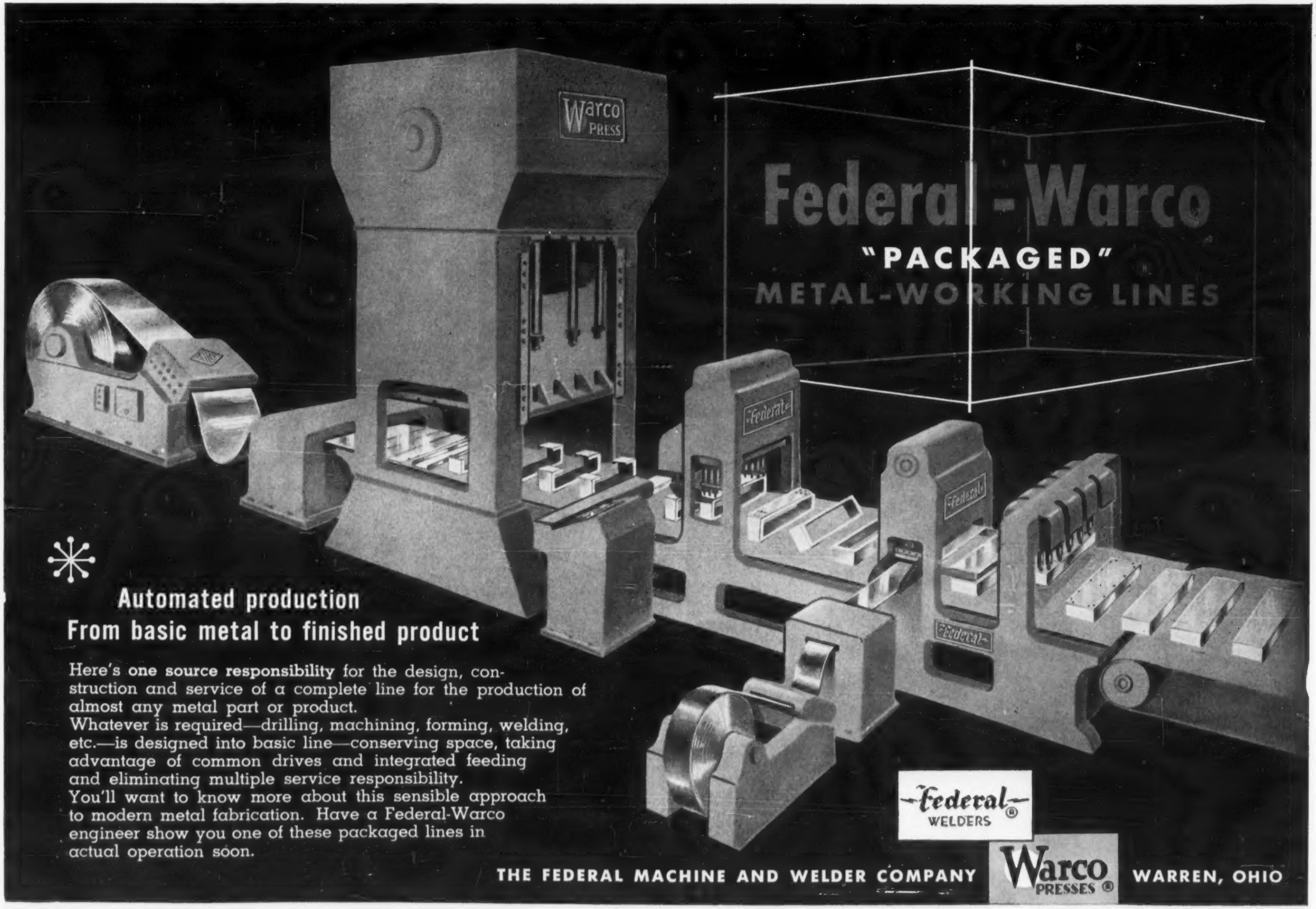
WIRE
Allegheny Ludlum Steel Corp., Pittsburgh, Pa. (Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Pa.
Crucible Steel Co. of America, Henry W. Oliver Bldg., Mellon Square, Pittsburgh 22, Pa.
U. S. Steel Corp., (American Steel & Wire Co. Div., Columbia Steel Co. Div. Tennessee Coal, Iron & R. R. Co., Div.) 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINES
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
Nilson, A. H., Machine Co., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WOODWORKING MACHINES
Atlas Press Co., Kalamazoo, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Onsrud Machine Works, Inc., Niles, Ill.
Pope Mchry. Corp., Haverhill, Mass.

WRENCHES, Allen, End, Socket, Adjustable, etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Standard Pressed Steel Co., Jenkintown, Pa.
Williams, J. H., & Co., 400 Vulcan St., Buffalo 7, N. Y.

WRENCHES, Power Chuck
Cushman Chuck Co., 806 Windsor St., Hartford 2, Conn.


Warco PRESS
Federal-Warco
"PACKAGED"
METAL-WORKING LINES
Federal
Federal
Federal
Automated production
From basic metal to finished product
Here's one source responsibility for the design, construction and service of a complete line for the production of almost any metal part or product.
Whatever is required—drilling, machining, forming, welding, etc.—is designed into basic line—conserving space, taking advantage of common drives and integrated feeding and eliminating multiple service responsibility.
You'll want to know more about this sensible approach to modern metal fabrication. Have a Federal-Warco engineer show you one of these packaged lines in actual operation soon.
Federal® WELDERS
THE FEDERAL MACHINE AND WELDER COMPANY
Warco PRESSES ®
WARREN, OHIO

Classified Section

CLASSIFIED ADVERTISING RATES: $12 per single column inch

eastern Rebuilt Machine Tools

THE SIGN OF QUALITY

THE MARK OF DEPENDABILITY

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard—THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS

MISCELLANEOUS

Model RP Tompkins & Johnson Pneumatic Riveting Mach. with cylinder
No. 53A-Sundstrand Double End Opposed Type Drilling & Centering Machine
No. 125 Marken Marking Machine, m.d.
Sciaky Type PMCO-2S-31 Storage of Energy Spot Welder, 50 KW, 34" throat
No. 70 Cross Deburring Machine, m.d., 1940
Pratt & Whitney Standard Measuring Machine, 36" capacity
Type 114CB Moline Tool Boring Machine, two spindle type, m.d.
15" Gleason Quenching Press
No. 11 Cochran Bly Saw Sharpener, belt drive
Logan Hydraulic Vertical Shaper, m.d., 6" stroke
Gisholt Precision Balancing Machine, m.d.
LeRoe Electric Power Plant
38" face plates, lathe, taper nose, key mounted, new
Hanchett Grinding Head, vertical type for mounting on planer rail
24"x60" Magnetic Chuck
16"x60" O. S. Walker Magnetic Chuck
Clamping Assembly to fit a 6.2 Denver Acme Turret Lathe
1 ton Shaw Electric Cable Hoist
Brown & Sharpe Universal Attachment, for use on 2A Brown & Sharpe Miller
63" Walker Rotary Magnetic Chuck, 230 volt D.C. new
Portable Greasing Machine, motor operated
Megatherm H.S. Induction Heating Unit
2 spindle Keller Machine
Model 50M, 50 ton Lempco Hand Operated Hydraulic Press, new
Model 75M, 75 ton Lempco Hand Operated Hydraulic Press, new

AUTOMATICS

9/16" Cleveland Model A, m.d., 1943
1-1/16" Cleveland Model B, m.d.
4 spindle 1⅝" Cleveland, m.d.
4 spindle 2" Model K Cleveland, m.d.
2" Cleveland Model A, single spindle, m.d.
2⅝" Cleveland, m.d., Model A
No. 8A Cleveland, m.d., 8" cap., latest
No. 4D Potter & Johnson, m.d.
No. 5 DELX Potter & Johnson, m.d. lathe

BOLT THREADERS

Victor Nut Facing Machine, m.d., cap. ⅜" to 2" nuts
1½" Landis 2 spindle, m.d.
1½" Landis 4 spindle, m.d.
1½" Landis Stay Bolt Threading Machine, Double Head, m.d.
No. 326 Oster Bolt & Pipe Threading Machine, m.d.

HORIZONTAL BORING MILLS

No. 1 Cleveland Horizontal Boring, Drilling & Milling, m.d.
5½" bar Betts Floor Type, m.d.
5½" bar Niles-Bement-Pond, m.d.
6" bar Sellers Floor Type, m.d.
10" bar Sellers Floor Type, m.d.
Barrett Double End. 5" and 7" spindle, m.d.
Floor Plates—all sizes

VERTICAL BORING MILLS

16" Bullard Mult-Au-Matic, m.d.
24" Bullard Spiral Drive, m.d.
30" Bullard Man-u-trol Type, m.d.
36" Bullard, m.d., late
42" King, direct m.d.
42" Bullard New Era, m.d.
44" Putnam, m.d., p.r.t.
48" Niles-Bement-Pond Car Wheel Borer, m.d.
53" Niles Heavy Pattern, m.d., p.r.t.
53" Niles Heavy Pattern, vee belt m.d., latest
102" Niles Wheel Turning Boring Mill

BROACHING MACHINES

75 H.P. LaPointe Hydraulic Broach, m.d.
12x72" Thompson Automatic Flat Broach, m.d.
10 ton, 84" stroke LaPointe Single Ram Vertical Surface Broach, m.d., late
Type SBD-42-6 American Vertical Hy. Dup. Broach
Type SBD-48-15 American Vertical Dup. Ram Surface Hydr. Broach
No. 3 Oilgear Hydraulic Broach, type XA, 54" stroke, m.d.

RADIAL DRILLS

4'—13" American Hole Wizard, m.d.
5'—14" col. American Triple Purpose, m.d.
5'—15" col. American, m.d., on arm
6'—17" col. American Hole Wizard, m.d.
7'—16" col. American Triple Purpose, m.d.
7'—17" col. American Hole Wizard, m.d.
8'—17" col. Dreses, gear box m.d.
Baush Radial Drilling & Tapping Machine, m.d.

BALL BEARING DRILLS

No. 4 Fosdick, 8" overhang, H.S., m.d.
No. 15 Buffalo Floor Model, m.d.
No. ½, 1 & 2 Avey, m.d.
No. ½ Avey MA-8, m.d.
No. 1B Edlund, m.d., new
No. 4BM Fosdick, single spindle, H.S., m.d.
1 spindle No. 2MA6 Avey High Speed, m.d., 7½" overhang, 1943
No. 2B—8" H.D. Edlund, H.P., m.d.
2 spindle Atlas Bench Type, 1942
2 spindle Allen, belted m.d., 8" overhang
2 spindle No. 2 Avey High Speed, belted m.d.
2 spindle No. 2B MA1 Avey Production Type, m.d.
2 spindle Avey, size No. 1, Type B, style VHP, m.d., 8" overhang
2 spindle No. 3 MA6 Avey High Speed, m.d.
2 spindle No. 2 Leland-Gifford High Speed, 8" overhang, m.d.
2 spindle Leland-Gifford High Speed Hydraulic Type, m.d.
No. 2LMS Leland-Gifford, single spindle, H.S., m.d.
3 spindle No. 2MA6 Avey H.S., m.d.
3 spindle Leland-Gifford #1 LMS—High Speed, m.d., late
3 spindle Leland-Gifford H.S., m.d.
3 spindle Delta H.S., 4 speed vee pulley drive
4 spindle Leland-Gifford, m.d. on each spindle
6 spindle Leland-Gifford, m.d. on each spindle, No. 2 taper
6 spindle No. 1 Avey High Speed, m.d.
Walker Turner H.S., vee belt drive

The above is only a partial listing
WRITE FOR COMPLETE STOCK LISTING

THE EASTERN MACHINERY COMPANY
1004 Tennessee Avenue, Cincinnati 29, Ohio • MElrose 1-1241 • Cable Address EMCO

HIGH GRADE QUALITY TOOLS

1½" National upsetting and forging machine (2)
3" National upsetter
3" Ajax upsetter
3"-3½" Ajax steel frame upsetter
4" National high duty upsetting and forging, air clutch, (2)
7½" National high duty air clutch forging and upsetting machine
Economy Type R automatic threading and pointing machine
9/16" National precision thread roll
36" Rockford openside shaper-planer, mechanical
10½" x 10½" No. 3 Motch & Merryweather cold saw, late
10" x 10" Racine hydraulic shear cut saw, late
6" x 6" Peerless universal shaping saw
6" x 6" No. 6 Marvel high speed ball bearing
750 ton No. 3 National Maxipress all steel forging press, late
106 ton No. 78 Toledo single crank overhanging gap frame (3)
60 ton Henry & Wright dieing press
50 ton Henry & Wright dieing press (2)
43 ton No. UA 43 Niagara adjustable knee punch press
95 ton No. 8 Bliss Consolidated OBI (2)
22 ton No. 60-2½-24 Minster double crank OBI
113 ton No. 66 Bliss Consolidated straight side tierod frame DBG
126 ton Model 60-D-66 Cleveland straight side double crank tierod frame press
30" x 30" x 8' Cincinnati hypro-planer, two rail, one right hand side head
Model CT-36 Lees Bradner thread mill, internal and external threading
No. 4 Lees Bradner universal thread mill
Hall Planetary thread and circular form mill
6" x 36" Lees Bradner thread mill
4" bar Universal Tri-Way horizontal boring, milling and drilling machine
3" bar Universal Tri-Way Model 30 horizontal boring, milling and drilling machine

WRITE FOR YOUR STOCK LIST

MILES MACHINERY CO.
PHONE SAGINAW PL 2-3105
2045 E. GENESEE AVE. SAGINAW, MICH.

BUSINESS OPPORTUNITIES

METAL PROD. MNFG. CO. S. E. Tex. (Utility tables, barbeque bars, shelving, laundry tubs, etc.—all modrn design: most in decorator's colors!) A-1 loc. 13,000 sq. ft. Xeptnl wrk. cond. & functional eqpt. Nets $26,000! Last yr. vol: ¼ Million! Write for brochure! Ref. B9107.

MACHINE SHOP, W. C. Ark. Self-oper. Ideal hub loc & A-1 eqpt. Est. '11! Free & Clear! Terms avail! Details avail on req. Ref. B9177

MACH. SHOP, Los Angeles area Calif. Nets $25,000 w/5 empl in non union shop! Est. 47. Details on req. Ref. B24402.

ALUMINUM FOUNDRY, W. Cen. Wash. (60% gen. cast. & 40% aircraft.) Firm recent. cert. by U.S.A.F.! 8,500 sq. ft. w/6 furnaces & compl. fac. Est. '46 w/sales: $153,585. Write for brochure! Ref. B24340

FOUNDRY, S. Cen. Ariz. Incl. R. E. 500x300 ft. In choice prop. area! Quan. goods in process. Compet. lite! Terms avail! Write for brochure. Ref. B24356

INDUSTRIAL EQPT. S. Nev. (Sales & Svce.) Some farm machns & auto wrk. Major City loc w/accts thruout Nevada! 2 empl. in 3 bldgs. All free & clear! Detailed brochure on req. Ref. B24370

JOBBING MACHINE SHOP, Cen. Pa.—(Special. in precision prts & assemblies.) 4 acres w/17,168 sq. ft. bldg. Xlnt equpt & A-1 loc. for raw mat. Accts thruout States! '56 Sales over $160,000. Write for brochure offering real oppty! Ref. B42593

SCREW MCHNE PROD. MNFG.—Chicago area. Ill. Sales $80,000 w/stdy accts since being est. '39. A-1 eqpt. Substan. poten! Write for details. Ref. B62223

MANUFACTURING, heavy FARM EQPT. Cen. Iowa.—(also parts). Est. 1895 w/3,300 ret. dealer accts! Over 4 acres w/120,000 sq. ft. under roof! Direct R.R. spur! $22,000 income from sub-lease! Realistic assets! Write for detailed brochure & photo! Ref. B-62240

HALF INTEREST-RIVET MFG. S. Cen. U.S. Sales $150,000 w/expan. oppty! Nrst compet.—Illinois! Write for oppty details! Ref. B62258

BUSINESS MART of AMERICA
6425 Hllwd Bl., Los Angeles, Calif.

MACHINERY'S HANDBOOK

The Bible of the Mechanical Industries

Do you own the 15th Edition?

MACHINE TOOLS

17" x 8' LEBLOND "REGAL" Lathe, Complete toolroom Equipment, 1951. 6 Spindle LELAND-GIFFORD No. 2 LMS 20" Drill Press, Late Type.

No. 2, No. 3 CINCINNATI H.S. D.T. Horiz. Mill, NEW 1945. Exrta table travel, vert. heads.

FALK MACHINERY CO.
19 Ward Street—BA 5-5887—Rochester, N. Y.

GEARS DESIGNED

Also consultants on gear noise and gear life problems for all type gears.

GEAR CONSULTING SERVICE
P.O. Box 12, University Station
Syracuse 10, New York

BRITISH MACHINE SHOP

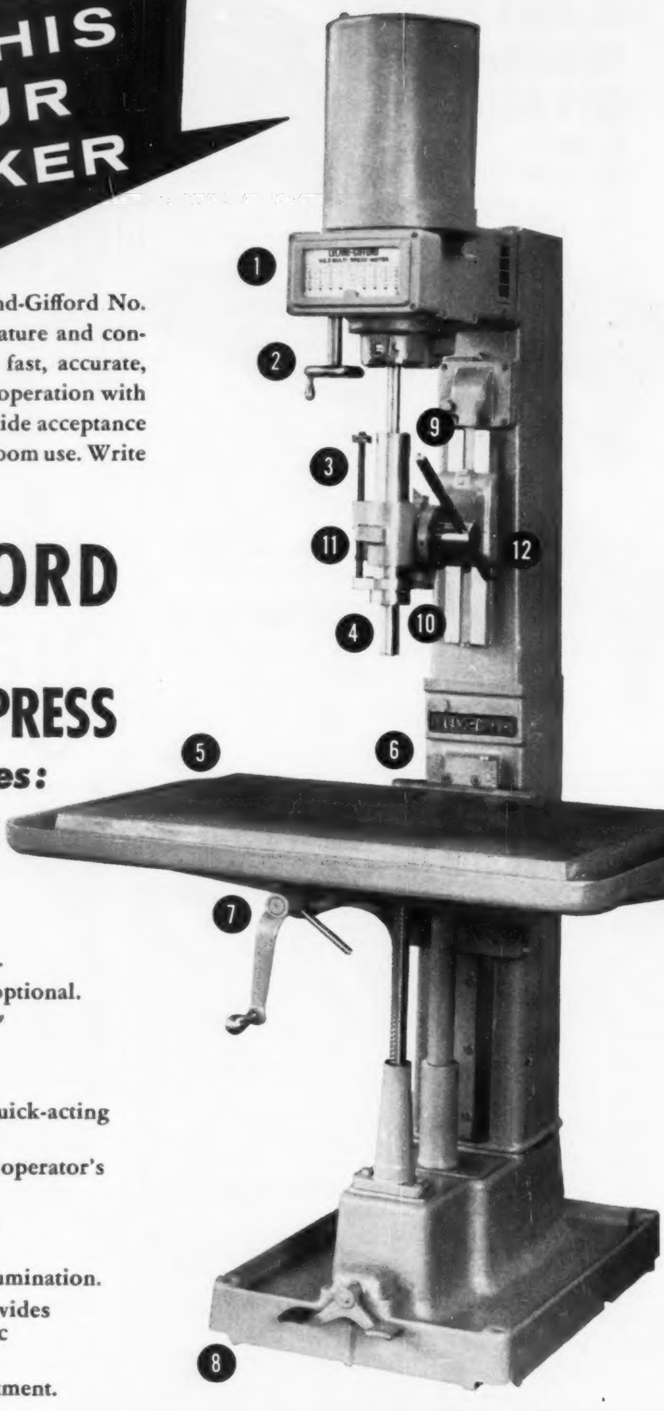
Seeks contracts for high class machine and machine tool parts, including planing and slideway grinding or licence to build complete machine tools, handling facilities to five tons.

BALDING Engineering Ltd.
Sandy Lane, Norwich,
ENGLAND

For more information fill in page number on Inquiry Card, on page 223

SHOW THIS TO YOUR TOOLMAKER

Ask him if he doesn't agree that the Leland-Gifford No. 2LMS Toolroom Drill Press provides every feature and convenience needed in the modern toolroom for fast, accurate, effortless drilling and tapping. Developed in cooperation with leading tool engineers, this machine has won wide acceptance as the ideal drill press for general purpose toolroom use. Write for complete information.



LELAND-GIFFORD
No. 2LMS
TOOLROOM DRILL PRESS
with all these features:

1 Illuminated indicating shift with cutting speed chart.
2 Conveniently located hand wheel for changing spindle speeds and shifting back gears without stopping machine.
3 Positive stop for accurate depth adjustment.
4 Capacity of No. 2 Morse taper. No. 3 MT optional.
5 Extra large 37" x 25" or standard 26" x 25" work table.
6 26" swing with 13" overhang.
7 Handy push-back table raising crank and quick-acting table lock.
8 Foot switch start-stop motor control leaves operator's hand free.
9 Counterbalanced sliding head for effortless vertical adjustment.
10 Built-in light for table and work surface illumination.
11 Reversing motor control for tapping — provides manual control from feed lever or automatic control by depth stop.
12 Sensitive hand lever feed with ratchet adjustment.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U. S. A.

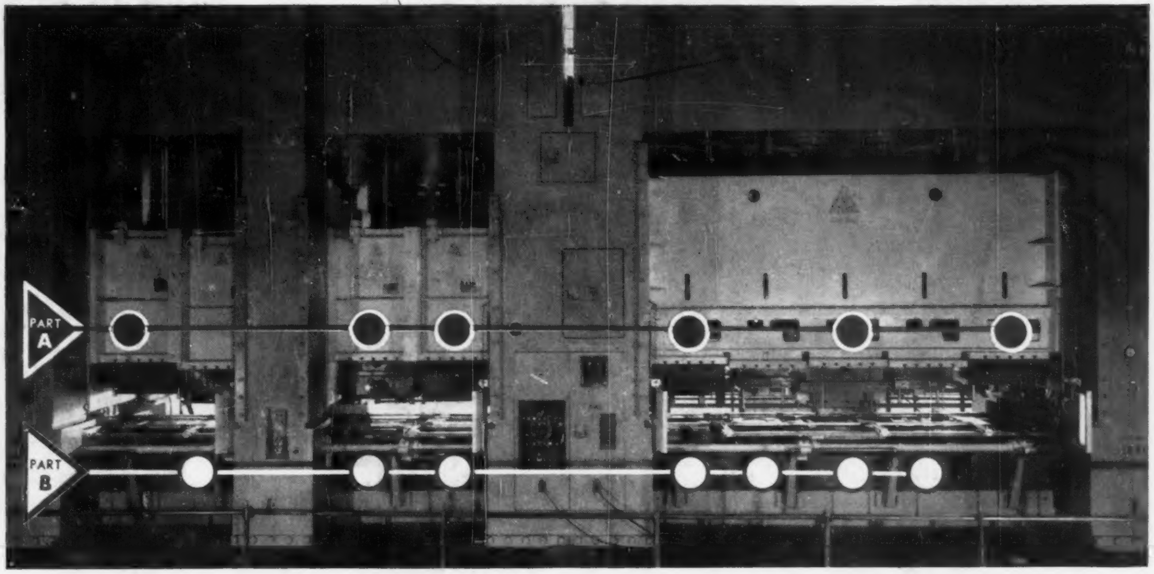
CHICAGO 45 2515 West Peterson Ave.
DETROIT 10429 West McNichols Rd.
CLEVELAND 22 P.O. Box 853
NEW YORK OFFICE 75 South Orange Ave. South Orange, N. J.
LOS ANGELES OFFICE 2620 Leonis Blvd. Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

For more information fill in page number on Inquiry Card, on page 223

ALPHABETICAL LIST OF ADVERTISERS

ALPHABETICAL LIST OF ADVERTISERS

For more information fill in page number on Inquiry Card, on page 223



A Clearing modular press equipped with one large single slide and two pairs of split slides produces washer tops for several hours, then converts in minutes to producing dryer tops.